THE HEATING AND VENTILATING MAGAZINE

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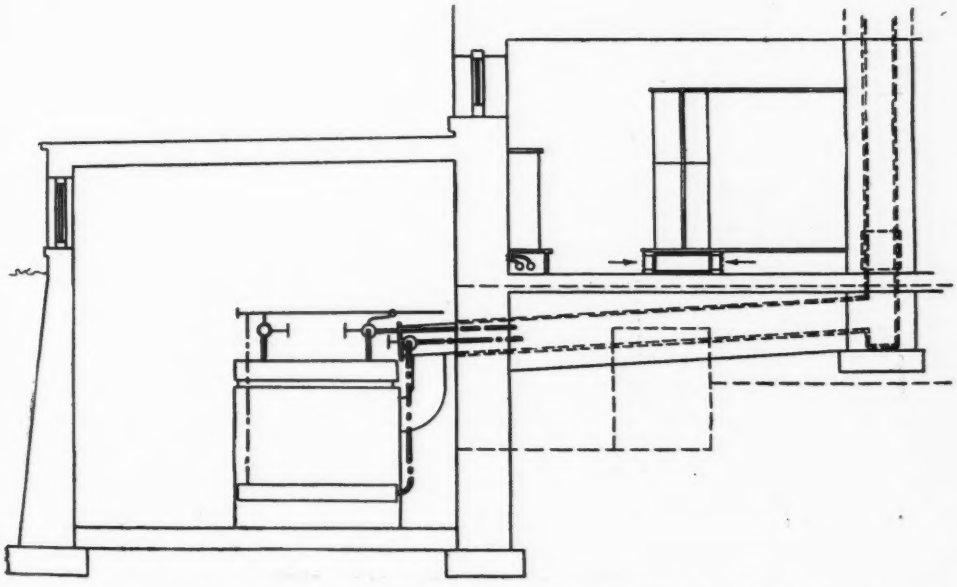
Exhaust Ventilation for a Y. M. C. A. Building

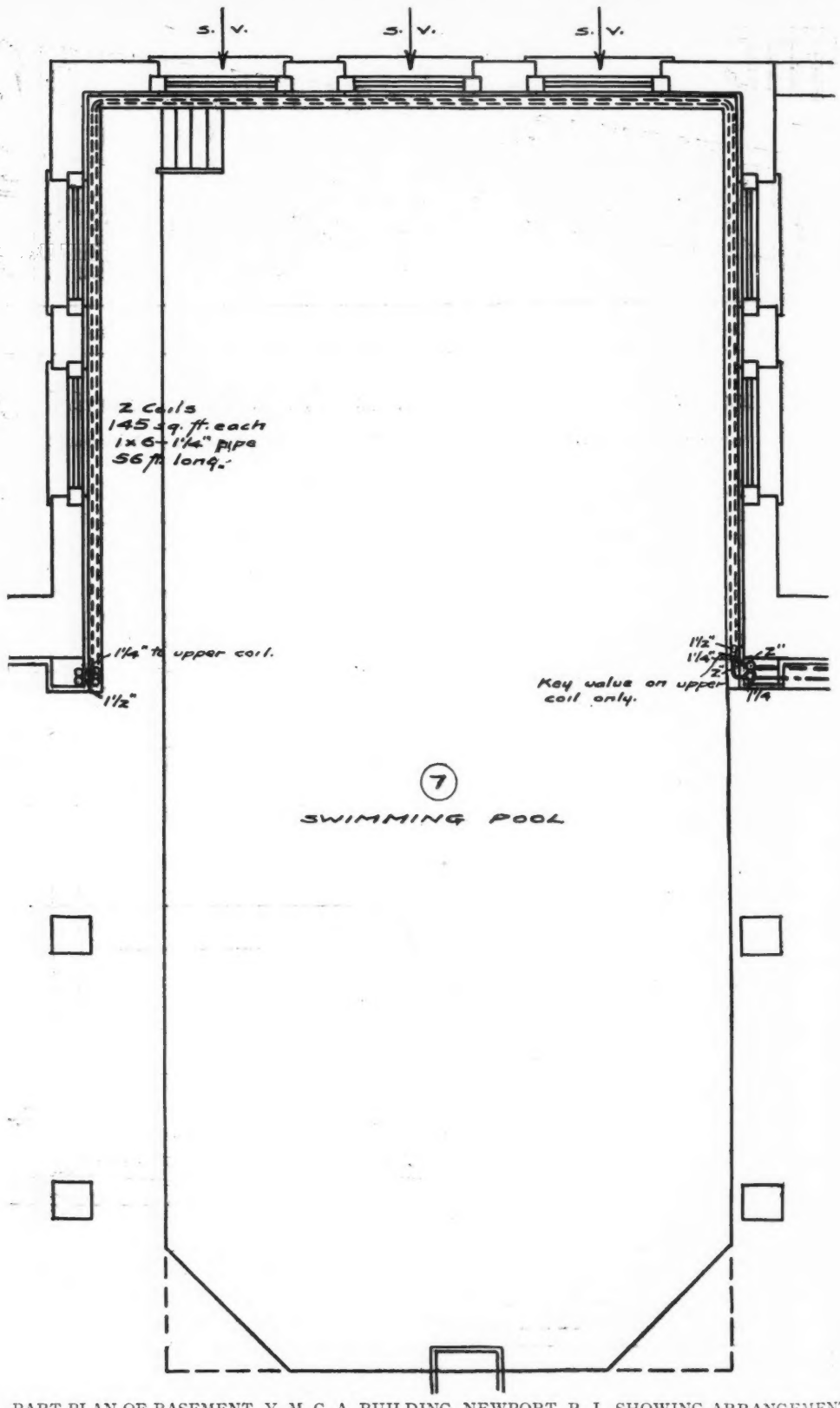
Novel Arrangement for Heating Swimming Pool Room and Elimination of Basement Ducts

A well-defined movement toward greater neatness and compactness in the arrangement of heating and ventilating apparatus is to be seen in many of the more recent installations. The accompanying illustrations, for instance, show the direction the movement is taking in clearing the basement spaces, as far as possible, of heating apparatus and, at the same time, eliminating dust pockets and similar unsanitary and unsightly features. The plans shown are those for the Y. M. C. A. building at Newport, R. I. This is a typical Y. M. C. A. structure, with swimming pool and locker rooms in the basement.

The only space sacrificed to the equipment is the boiler room, which also contains plumbing apparatus. The heating mains are run in accessible trenches with soil and other pipe lines. The cross section gives an idea of the manner in which the air ducts and flues have been disposed of. They are generally grouped in the small rooms of which



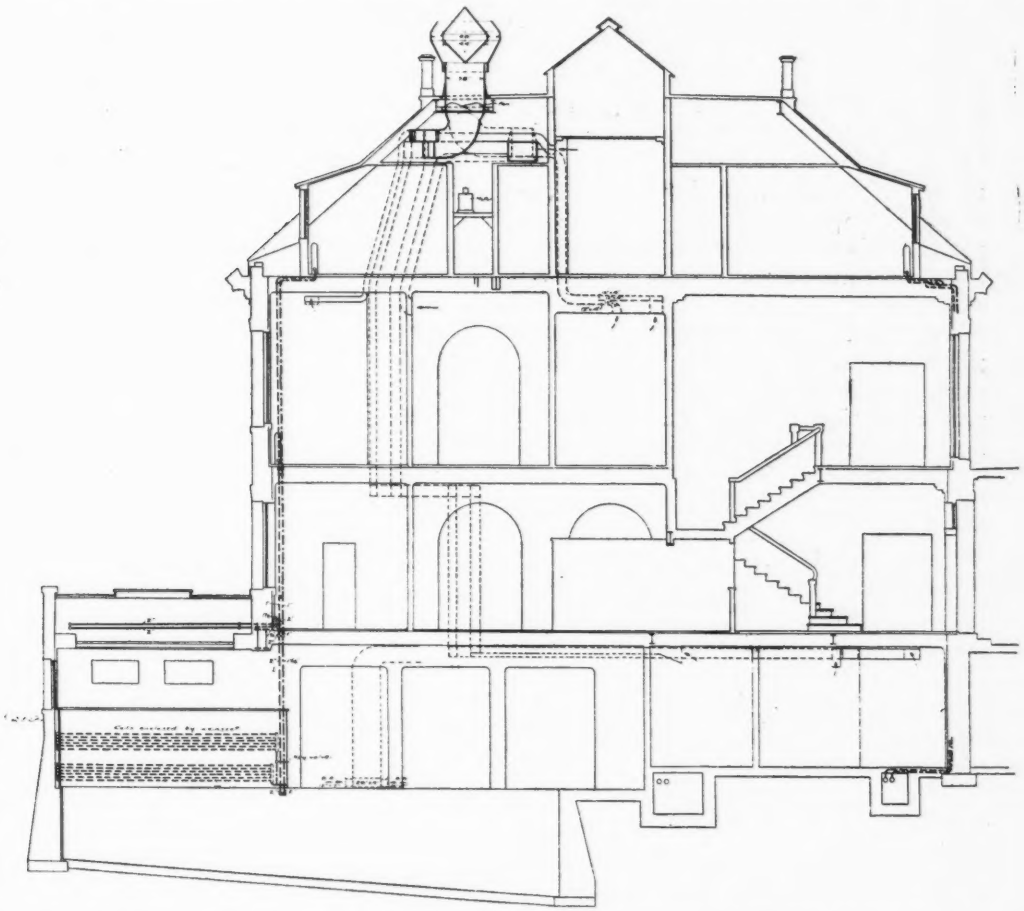
SECTION THROUGH BOILER ROOM AND LOCKERS, Y. M. C. A. BUILDING, SHOWING VENTILATING DUCTS UNDERNEATH LOCKERS



PART PLAN OF BASEMENT, Y. M. C. A. BUILDING, NEWPORT, R. I., SHOWING ARRANGEMENT OF CONCEALED HEATING COILS IN SWIMMING POOL ROOM

the ceilings are furred down to conceal the ducts so that there is no appearance throughout the building of their existence. Owing to its planning the building presents no severe conditions such as would require a forced supply of tempered air, but all the requirements of ventilation are taken care of by mechanical exhaust. The electric fans for this purpose are located in small waste spaces above the attic floor so that the entire ventilating system is at the same time effective and inconspicuous.

Perhaps the most interesting feature of this equipment is the method adopted for heating the apartment containing the swimming pool. The coils in this room are placed behind marble wainscoting and made air tight. The room is heated entirely by convection through the marble surfaces. To make this possible, the heat requirements for the room have been reduced by taking care of the skylight, which represents a great part of the exposure, by a coil within the same. This arrangement is clearly shown both in the cross section and in a portion of the basement plan. It will be noted by referring to the basement plan that the stairway leading down into the swimming pool is near one of the exposed walls. The marble wainscot is, therefore, a protection for the bather against contact with the coils, the wainscot never exceeding a temperature of about 110° F. It also serves the double purpose of protecting the bather and the coils, besides



CROSS SECTION OF Y. M. C. A. BUILDING, NEWPORT, R. I., SHOWING METHOD OF CONCEALING VENTILATING SYSTEM, ALSO COILS FOR SWIMMING POOL ROOM

adding to the appearance and hygienic qualities of the room.

The plant was designed by Mr. Konrad Meier, of New York, and was installed by the A. Burlingame Co., Worcester, Mass. The architects are Ewing & Chappell, New York.

Heating and Ventilation of Federal Buildings

By Nelson S. Thompson

(Concluded from last issue)

For direct-indirect heating a speed of 5 ft. per second through the cold-air inlet duct to the radiator is assumed to ascertain the amount of air which must be raised from exterior temperature to that of the room. This speed has been observed in several anemometer tests of these systems.

The heat losses through wall and glass are ascertained by using the exposure factor the same as in direct radiation, but in lieu of using leakage factors the number of B. T. U. required to raise the temperature of air introduced through radiator from the lowest recorded to room temperature is ascertained. 300 B. T. U. per square foot for steam flue radiators and 200 for hot water are allowed. In selecting the boiler the direct-indirect is reduced to direct equivalent by adding 20% to the actual direct-indirect radiation installed.

Vent flues, with a positive outflow, such as is created by a fan, or an aspirating coil, are provided to assist inflow of air through the direct-indirect radiators. A speed of 3 ft. per second in vent flue connected into a good roof ventilator properly located is allowed.

This system is sometimes used with hot-water heating apparatuses, but its use is not desirable where the lowest on record is below 5° F.

GRAVITY INDIRECT RADIATION

The office practice is to assume that the temperature of entering air under extreme outside conditions will be 120° F. for steam and 100° F. for hot water.

The amount of radiation to install is ascertained by the B. T. U. method, taking into account the heat losses through wall, glass and ceiling, and making allowance for exposure, and in addition, allowing 10% for loss of hot air through window cracks. The B.T.U. ascertained as above and multiplied by 55 and divided by 50 for steam and by 30 for water will give the number of cubic feet of air which must be admitted to the apartment per hour to heat it.

The number of B. T. U. required to raise the temperature of the air from the lowest outside temperature to 120° F. for steam and 100° F. for water plus 5° (allowance for temperature drop in flue) is ascertained and the resulting number of B. T. U. is divided by 350 for steam indirect, natural draft, and 220 for hot-water indirect, natural draft.

The size of hot-air flues and ducts to be installed is ascertained by assuming the following speeds:

Air speed to first floor 200 ft. per minute.

Air speed to second floor 300 ft. per minute.

Air speed to third floor 400 ft. per minute.

The vent flues and cold-air ducts are made the same size as hot-air flues.

In climates 10° F. and below the 12-in. or 15-in. deep extended pin radiators for steam and in all climates similar radiators are used for water. For climates, where temperature is below 10° F. two 12-in. deep radiators for hot water are used.

The allowable speed through cast-iron pin indirect radiators for natural draft is limited to approximately 2 ft. per second through one section deep. High speeds necessitate the placing of one section on top of another with a space of about 4 in. between the sections. 5 ft. per second through the radiator is the limit with natural draft.

The check rules for indirect flues when room is to be heated by hot air is to make same equal in square inches to the area of glass in square feet plus one-fourth area of exposed wall in square feet. No flue to be wider than three times its depth.

None of the cast-iron indirect radiators contain the amount of surface claimed for them in the manufacturers' catalogs, and to be conservative 20% of the amount claimed should be deducted in laying out and installing same.

ONE PIPE STEAM DIRECT RADIATOR TAPPINGS, ARMS AND RISERS.

Direct Radiation, Sq. Ft.	Tapping, In. Diam.	Riser and Arm in Basement and Radiator Arm, In. Diam.
0—20	1	1
21—24	1	1¼
25—40	1¼	1¼
41—60	1¼	1½
61—80	1½	1½
81—100	1½	2
101—200	2	2

At ends of mains increase tapping one size.

No main to be less than 1¼ in.

To get size of mains and risers serving more than one radiator, add area of tappings together and use the following equalizing table:

TABLE OF EQUALIZING PIPES.

½ in. equals	2
¾ in. equals	5
1 in. equals	10
1¼ in. equals	20
1½ in. equals	30
2 in. equals	60
2½ in. equals	110
3 in. equals	175
3½ in. equals	260
4 in. equals	380
5 in. equals	650
6 in. equals	1050

ONE PIPE STEAM MAINS FOR RUNS UP TO 200 FT. IN LENGTH

Size of Flow Pipe, In. Diam.	Direct Radiation, Sq. Ft.	Dry Returns, In. Diam.	Wet Returns In. Diam.
1	40	¾	¾
1¼	75	1	¾
1½	126	1	1
2	286	1¼	1
2½	535	1½	1
3	890	1½	1
3½	1360	2	1
4	1950	2	1
5	3600	2½	1¼
6	5900	3	1½
8	12700	4	2
10	22900	5	2½
12	37000	6	3

For other length of runs see formula given with the two-pipe schedule. In patent steel steam boilers two tappings are used of such size as to keep velocity of steam in the verticals down to not over 20 ft. per second.

TWO PIPE BASEMENT MAINS, GRAVITY CIRCULATION, DIRECT HOT WATER RADIATOR TAPPINGS.

Direct Radiation, Sq. Ft.				Pipe Size, In. Diam.
First Floor.	Second Floor.	Third Floor.	Fourth Floor.	
40	50	60	70	¾
70	80	90	100	1
110	120	135	150	1¼
180	195	210	230	1½
300	350	400	500	2

7	in. equals	1600
8	in. equals	2250

If you have a ¾-in. pipe and a 1-in. pipe, to get size pipe to serve them—¾-in. equals 5; 1-in. equals 10; 15 equals 1¼ in.

RADIATOR TAPPINGS FOR TWO-PIPE GRAVITY DOWN-FEED HOT-WATER PIPING

(Flow main in attic and return in basement).

Radiator tappings same on all floors:

Direct Radiation, Sq. Ft.	Flow Pipe, In. Diam.	Return Pipe, In. Diam.
0—50	¾	¾
51—100	1	1
101—200	1¼	1¼

The size of mains and risers serving more than one radiator are ascertained by adding the areas of tappings and using the equalizing table before given. In this connection the main riser pipe from boiler to attic may be greatly reduced in size if a proper chamber or the expansion tank is placed at the top of the main riser.

SIZE OF MAIN RISER

The size of main riser may be taken from the following table:

Size of Main Riser, In. Diam.	Direct Radiation, Sq. Ft.
1½	300
2	600
2½	1200
3	2000
3½	2500
4	3500
5	6000
6	10000

ONE-PIPE CIRCUIT HOT WATER

The same tapping and risers as given for two-pipe hot water are used.

To arrive at size of one-pipe circuit hot-water mains the following sizes are used:

Hot Water Mains, In Diam.	Direct Radiation, Sq. Ft.	
	200 ft. Runs.	300 ft. Runs.
2	200	180
2½	400	300
3	600	500
3½	900	700
4	1200	1000
5	2300	1800
6	3600	3000
7	5200	4000
8	6800	6000

A 1-in. or 1¼-in. starting pipe is used with this system.

The length of mains is measured back to boiler.

Tees on main are kept 2 ft. apart. Risers are taken out of main on 45° and first floor connections out of top of main. All returns are taken into side of main. No special fittings are used, except twin ells on mains where they branch.

CAST IRON BOILERS

The experience of this office has been such as to lead us away from the use of cast iron sectional boilers, steel boilers being preferred. When conditions dictate the use of cast iron boilers their size is ascertained by adding to the actual direct radiation installed 25% for mains, if anthracite coal is used, and 35% if soft coal is used, and two boilers are installed, each rated to carry two-thirds of the result obtained above. One boiler will then, if forced, carry the radiation for a few days in case of a breakdown in one boiler.

To obtain the size of the stack when cast iron sectional boilers are used, the formula is:

$$\text{Area in square feet} = \frac{\text{Area of grate in square feet} \times 0.75}{\sqrt{\text{height of stack in feet.}}}$$

The tappings for steam connections to boilers are made not less than two in number and their combined area must be such that the velocity of steam is not over 12 ft. per second in the verticals.

Returns are connected into both sides of each cast iron boiler.

A 2-in. equalizing pipe from the bottom of the main header into the main return header is always installed on all patent steel or cast iron boilers.

TABLE FOR MAINS, RISERS AND TAPPINGS FOR TWO-PIPE STEAM HEATING SYSTEM. FOR 2 LBS. AND 5 LBS. STEAM PRESSURE.

Diameter of Supply Pipe, Inches.	Diameter of Return Pipe, Inches.	2 lbs. Pressure Total Heat Transmitted in B. T. U. per Hour.	Radiating Surface, Sq. Ft.	5 lbs. Pressure Total Heat Transmitted in B. T. U. per Hour.	Radiating Surface, Sq. Ft.
¾	¾	5,000	20	10,000	40
1	¾	9,000	36	15,000	60
1¼	1	18,000	72	30,000	120
1½	1¼	30,000	120	50,000	200
2	1½	70,000	280	120,000	480
2½	2	132,000	529	220,000	880
3	2½	225,000	900	375,000	1,500
3½	2½	330,000	1320	550,000	2,200
4	3	480,000	1920	800,000	3,200
4½	3	690,000	2760	1,150,000	4,600
5	3½	930,000	3720	1,550,000	6,200
6	3½	1,500,000	6000	2,500,000	10,000
7	4	2,250,000	9000	3,750,000	15,000
8	4	3,200,000	12800	5,400,000	21,600
9	4½	4,450,000	17800	7,500,000	30,000
10	5	5,800,000	23200	9,750,000	39,000
12	6	9,250,000	31000	15,500,000	62,000
14	7	13,500,000	54000	23,000,000	92,000
16	8	19,000,000	76000	32,500,000	130,000

Radiator assumed to transmit 250 heat units per square foot per hour. Above table is for pipes 200 ft. in length. For pipes of greater length, multiply results in table by 200÷e in which e equals length in feet. The values of this expression for different lengths of pipe are: For 300 ft., multiply radiation in table by 0.66 2/3; for 400 ft., by .50; for 500 ft., by 0.4; for 600 ft., by 0.33; for 800 ft., by 0.25; for 1,000 ft., by 0.2.

STEEL BOILERS

In Federal buildings of small size in which a down-draft furnace is not to be used, consideration is given the installation of a round, vertical steel boiler. The maximum size for this type of boiler is one with 28-in. diameter grate.

A down-draft furnace is not attached, even when bituminous coal is the cheapest fuel, until size of boiler required is such as will serve 2,600 sq. ft. of direct steam radiation. The down-draft furnaces are installed to comply with the local smoke ordinances which exist in many cities and towns.

Where small-size anthracite coal is the cheapest fuel, the boiler and grates are installed to use that fuel, and the maximum openings in the grate bars are specified not to exceed ⅜ in. The size of boiler to be used, when small anthracite coal is the cheapest fuel, is obtained by adding 50% to actual direct radiation installed.

When the cost of 20,000 cu. ft. of natural gas is cheaper than one ton of the cheapest coal, the boiler is equipped with burners, pilot light and governor. The boiler rating for use with gas is ascertained by adding 25% to actual direct radiation installed.

When bituminous coal is the cheapest fuel, 35% is added to the actual amount of direct radiation installed to get boiler rating, and no allowance is made for additional heating surface in the water-tube grates of down-draft furnace.

When three times cost of oil per barrel plus the cost of 7 K. W. hrs. of electric current per day (generally 70 cents), is less than cost of one ton of the cheapest coal, oil is used as a fuel, and the boiler is equipped with oil burners, pump, tanks, etc.

The size of boiler for use with oil is ascertained by adding 25% to actual direct radiation installed.

When the catalog rating of the vertical steel boiler required exceeds

3,000 sq. ft., the advisability of installing either two small, portable steel boilers, a 3600-ft. portable steel boiler, or a horizontal return tubular boiler, is considered.

All ratings given above are direct steam ratings and the remarks apply to hot-water boilers of equivalent capacities.

Where a horizontal return tubular brick-set boiler is to be installed the same is proportioned as follows:

R = total direct radiation in building in square feet.

B.H.S. = heating surface in boiler in square feet.

C = area of grate in square feet.

B.H.S. = R/7 for steam; R/11 for water.

G = B.H.S./25 for anthracite, pea or rice, and B.H.S./30 for nut anthracite.

G = B.H.S./30 to 35 for bituminous coal.

G = B.H.S./45 for lower grate of down-draft furnace.

H = height of stack in feet.

A = Area of grate in square feet.

S = Area of stack in square feet.

$$S = \frac{A}{\sqrt{H}}$$ for anthracite lump coal, oil and gas.

$$S = \frac{A}{\sqrt{H}} \times 1.25$$ for bituminous and small anthracite.

For anthracite, pea or rice coal, the tube area must be not less than one-eighth grate area, and always larger than stack area.

For boilers with down-draft furnace attached the tube area must be not less than one-sixth area of lower grate and always larger than stack area.

Maximum length of tube must not exceed 48 diameters.

Maximum length of boilers, 54 in. diameter and under, 3 diameters, over 54-in., 2½ diameters. Tubes an odd number of feet long are not used.

Coal consumption for low-pressure heating apparatuses in tons per heating season will be found as follows in Government buildings:

Area of grate or grates in square feet multiplied by 5 equals tons of coal burned per heating season of 240 days.

A safe rule is that for each cubic foot of contents of building one pound of coal will be required to heat building for heating season of 240 days.

To find size of coal storage room for a Government building, allow 8 sq. ft. of floor space per ton of coal, and it is arranged to store the entire season's supply in the small buildings.

To ascertain boiler horse-power for heating of a building in New York City, or a similar climate, allow 100 boiler horse-power for each 1,000,000 cu. ft. of contents for zero weather, and in average winter weather, two-thirds of this will be the horse-power required. Between 40% and 50% of maximum will be the boiler horse-power required for the full heating season of 5,700 hours. An excellent rule is to assume that each square foot of radiating surface in the building, direct and indirect, will require 1,000,000 B.T.U. per season of 240 days.

WATER-TUBE BOILERS

In all buildings where steam is to be used for power purposes, or is likely to be so used at some future time, water-tube boilers are installed.

The minimum size of water-tube boiler installed is 100 H. P. All water-tube boilers are rated at 10 sq. ft. of heating surface per horse-power. The clear height from bottom of firing pit to under side of ceiling beams must be not less than:

For boilers 150 horse-power and smaller	14 feet, 6 inches.
For boilers 150-175 horse-power	15 feet, 0 inches.
For boilers 175–200 horse-power	15 feet, 6 inches.

It is not deemed advisable to publish in this paper the basic data used in proportioning the mechanical ventilating apparatus for the large buildings other than to say that the

formula of Professor Kinealy is used to determine size of fans and horsepower of motors to operate same: that the speed through air washer is limited to 400 ft. per minute of net area; that the speed through the blast coils in generally limited to 1,000 ft. per minute and that the main plenum duct speeds are limited to 1,800 ft. per minute, and the use of volume dampers obviated by contracting the connections from main ducts to the upcast flues, and amount which is based on the calculated pressure which will exist and be maintained at that point, when fan is running at maximum determined speed.

The design of the above systems is in process of revision, and when the final data are worked out, a paper stating the basic data will be submitted to the society.

The office feels the need for definite information on the subject of ventilation and has taken steps to detail a trained employee to visit completed and occupied buildings and make anemometer tests of the ventilating apparatus and determine the purity of the air in the ventilated and unventilated buildings.

Only a small number of buildings have been visited so far, but, when the conditions permit, the investigations will be continued and some absolute facts will be learned and used as a basis to govern future designs of heating and ventilating apparatus.

All heating and ventilating apparatus, after being designed, must have their cost of installation approximated by the office, in order to check the proposals received; the department has prepared the accompanying data to approximate the cost, which has proved accurate within 5% when compared with the proposals received.

Approximate Cost of Heating Apparatus

Prepared by the Office of the Supervising Architect, Treasury Department, for the Purpose of Checking Estimates.

Boiler, vertical steel—take 50 per cent off price list.	
Labor to install, trim and test vertical steel boiler	$50.00
Down draft furnace (Hawley) in place	600.00
Foundation brickwork for boiler, per thousand, in place	20.00
Foundation concrete for boiler, per cubic yard, in place	8.00
Stone coping and steps for boiler pit, per cubic foot, in place	4.00
Breeching and stack, per lb., in place	.08
Cast iron base plate for stack, per lb., in place	.03
Radiators (average per sq. ft.) in place (not connected)	.20
Painting and bronzing, per square foot, radiation	.03
Radiator valves and air valves (steam), per radiator	3.50
Radiator valves and air valves (water), per radiator	4.50
Air valves at ends of mains, in place, each	.50
Standard gate valves on mains, 50 per cent. of list price in place.	
Labor, one pipe steam jobs per radiator	6.50
Labor, two pipe hot water jobs, per radiator	8.00
Frieght and drayage, 3 per cent. of cost of boiler, furnace, radiation, pipe and fittings	
Superintendent, 1 per cent cost of all labor and material.	
Non-conducting covering (pipe, boiler and breeching in place) take at 10 cents per square foot, of direct radiation.	
Pipe and fittings, one pipe steam, per radiator	7.00
Pipe and fittings, two pipe hot water, per radiator	10.00
8 foot wide return pipe trench, cast iron cover, per lineal foot, in place	1.50
Blow off pot (18 inches by 24 inches) in place, complete, with all pipe and valves	50.00
Expansion tank (40 gal.) in place, complete, with piping	25.00
Thermometers, in place, each	1.00
Hot water damper regulator (Sylphon type) in place, each	20.00
Board on out-of-town jobs, per radiator	2.00
Railroad fare can be readily ascertained when the distance the job is from headquarters is known. Assume for Federal buildings that it will average 300 miles and take railroad fare at	50.00
Profit	20%

The Profitable Operation of a Central Heating Station Without the Assistance of Electrical or Other Industries

By Byron T. Gifford

(Read from manuscript before the National District Heating Association, and here first published.)

Central station heating work has been carried on almost entirely in connection with the electric light plants, or, at least, with some plant in which the exhaust steam is sold for heating purposes, either by means of an exhaust steam or a hot water heating system. It is not my intention to advocate either one of these, but to confine myself to what has actually been done in central heating work, especially in straight fuel burning plants.

The history of central station heating has proven, beyond a doubt, that a heating plant can be made not only a physical, but also a financial success, if properly designed, installed and operated. This is equally as true of a straight fuel burning central station heating plant, as it is of a by-product plant, but, of course, the by-product plant is shown to have the larger financial return.

In the operation of a central station, operating entirely as a heating plant, we find the coal item to be our greatest expense; consequently a plant, to be successful, must burn as little coal as possible and yet give perfect service to the consumer. To do this requires giving attention to three branches of the work. First, the power station where the heat is generated must be designed and operated so as to utilize every heat unit that it is possible to take from the coal; second, the pipe line must be so designed and built as to be a very good conveyor of heat. The insulation of the pipe line cannot be too carefully chosen, bearing in mind always its two vital points, quality and durability, for nothing so seriously affects the future earning power of such a plant as its heat losses per foot of line, and the depreciation of its underground construction.

The third point to be considered is, the equipment of the buildings which are to be heated from the central plant. All buildings should be equipped so as to heat perfectly with a minimum amount of heat, thereby reducing the heating bill to the consumer, as well as increasing the capacity of the pipe line and consequently the heating system.

The remark has been made many times, that for a central station heating plant to be a success financially, it must be connected with some other fuel burning plant. I want to go on record, at this time, denying that statement, and I will endeavor to prove my stand, by giving here a few facts relative to a straight fuel burning central station heating plant. I was called upon to design a straight fuel burning steam heating system for a town of approximately 35,000 people; there had been a plant in operation in this town which had been installed seven years. This plant had been giving fairly good service, from the consumer's point of view, but had not been making any money for the stockholders. After carefully examining the plant and pipe line, I could easily see why such a state of affairs existed. The pipe line had been installed in wooden boxes. The line had not been underdrained, and consequently the pipe line, although having been installed only a short time, was in a very poor condition, the pipe having been eaten out in places.

The heating station equipment consisted of five return tubular boilers, fired by hand, with insufficient draft, and handling a very bad

water, containing 42 grains of solid matter to the gallon. This was done without a purifier, through a small heater, which, of course, did not give the desired result. With methods and boilers above mentioned, this heating plant operated with a profit of approximately 3% on its stock. No one could imagine or conceive a worse condition than that under which the plant was operated.

A TYPICAL HOT-WATER HEATING PLANT

In comparison to this plant I want to mention briefly a property operated as a straight fuel burning hot water plant; not giving the impression, however, that I consider that a heating plant must be a hot water plant to be a financial success, for a steam plant will operate equally as economically, other conditions being the same. The hot water plant to which I refer is properly managed and well operated, the coal pile is carefully guarded and excellent service has been given throughout this last winter, which, all heating men will admit, was an exceptionally severe one. This plant burned 86 lbs. of coal per square foot of radiation per season. The territory covered by this plant was comparatively large, the farthest point reached from the heating station is about 5,300 ft.

Straight fuel burning heating plants have been passing through the same stage of development and improvement that other utilities have passed through. The old time small electric light plant had to get at least 20c per kilowatt to show a balance on the right side of their ledger. Central station heating plants are to-day as sure and as safe an investment as any other public utility. The pipe line that is installed to-day is equally as durable as underground electric construction, and the heating station equipment is composed of nearly the same machinery which is sued in an up-to-date electric light power plant.

The greatest source of loss, whether a straight fuel burning or a by-product plant, is the line loss in the mains. This line loss in a steam heating plant is nearly constant and in a hot water heating plant varies directly as the temperature of the water inside the pipe. It is this one point, namely, line loss, which is especially important to central station heating plants. The larger the pipe and conduit, the greater the line loss per lineal foot of line under the same conditions; consequently, a plant designed to handle 200,000 sq. ft. of radiation, with all lines installed well, will show a line loss of from 10% to 20% with approximately 50% of the capacity connected, while the same plant will show a line loss of from 4% to 8% with the full capacity of the plant connected. The question, therefore, confronting our central station engineers, is, just what size line to install for a given load.

A piece of 4-in. pipe line 100 ft. long, on a central station hot water heating plant, will handle approximately 10,000 sq. ft. of radiation, this will therefore carry 1,800,000 B. T. U. per hour. The line loss from the pipe line will be, considering good construction, 14,000 B. T. U. per hour, showing a line loss of less han 1% of the total heat delivered. This case, however, only shows how economically heat can be distributed from a central station plant, but such a condition is seldom attained, even if the pipe line is carefully designed and well constructed.

LOCAL CONDITIONS GOVERN TYPE OF SYSTEM

Just what system should be chosen to serve a given territory depends, of course, entirely upon local conditions. In the past there have been heating plants built which show that practically no thought or engineering ability had been spent upon the design. The hot water advocate has his arguments and the steam heating advocate, of course, has his. But in my experience I have not met with a heating proposition that did not show that it was either a steam or hot water layout.

DIVISION OF OPERATING EXPENSES

In a straight fuel burning central station hot water heating plant the operating expense can be divided as follows:

Fuel	70%
Heating plant supplies	3%
Office supplies	2%
Repairs	5%
Labor and salaries	20%

This percentage has been taken from a plant in actual operation, and will serve as a guide in checking the operating conditions of a straight fuel burning hot water heating plant. This percentage, of course, will be somewhat changed in a straight fuel burning steam heating plant, due to the cost of water, if dumped into the sewer after all the available heat units have been taken out.

METER RATE OF CHARGING MOST SATISFACTORY

Another important feature in any central heating plant, and especially important in a straight fuel burning plant, is the manner in which the heat is sold to the consumer. There are in use to-day two methods, the meter basis and the flat rate besis. The flat rate basis is again divided into two methods, one charging so much per foot of radiation per season and the other charging so much per cubic foot of space heated. The meter basis is gradually becoming more universally used each year, as it is decidedly the most equitable way of serving the consumers. We find that in operating on a meter basis there will be less steam required per square foot of radiation per season than under a flat rate basis, due, of course, to the fact that on the meter basis the consumer will naturally use the heat as economically as possible, and this, of course, is a strong argument in favor of the meter on straight fuel burning plants. All the companies who have used meters have, only naturally, had more or less trouble educating the people to their use, but the electric light fraternity passed through the same trouble and there is no reason to doubt that the central station heating operators will find the same results in the end.

Central station hot water heating has never been sold on a meter basis, but by installing temperature control in a central station hot water heating plant, we find that the number of heat units used per cubic foot of space per season compares very favorably with the metered steam service.

DESCRIPTION OF A TYPICAL PLANT

We will assume, for the purpose of this paper, that we are going to install a central station hot water heating plant, exclusive of other utilities or industries, in a territory which will give us a probable load of 300,000 sq. ft. of radiation. We will also figure that the coal will cost us $1.50 per ton, and that the plant to cover this territory will cost $200,000 to build. The above assumption, as to investment, can be equaled in any case, consequently, I feel that we are assuming an average condition. We have an investment therefore of $200,000 on which to pay interest. The gross income from this plant, on a 17c flat rate, will be $51,000.00, exclusive of any percentage to the city for granting a franchise or any free heating, which might be done for the same reason.

The operating cost of the plant would be as follows:

Coal, 12,900 tons, at $1.50	$19,350.00
Heating plant supplies, 3%	829.00
Office supplies, 2%	552.00
Labor, salaries and taxes, 20%	5,552.00
Repairs, 5%	1,381.00
Total operating expenses	$27,664.00

This is approximately 52% of the income, which leaves a balance or net earnings of $23,336. Out of this amount the interest and depreciation must be taken care of. Assuming that the plant is bonded for 50% of the total cost, we have bond interest at the rate of 5%, which equals

$5,000, and a depreciation charge of 3% against the total investment of $200,000, making an item of $6,000, or a total interest and depreciation charge of $11,000, which shows us a balance or surplus of $12,336, out of which to pay dividends on $100,000 and create a surplus fund. This condition can be equaled and in many cases can be bettered.

In conclusion I wish to say that I do not want to give out the impression that a straight fuel burning central station heating plant will be a financial success under any and all conditions, but I do claim that such a plant will, under ordinary conditions, be not only a physical success, but also a financial success.

DISCUSSION

MR. LEWIS: Mr. Gifford gives us some figures on line loss, evidently based on the maximum capacity of the mains. We have found in Detroit that in order to satisfy our customers we have to keep steam on the mains between 270 and 280 days in the year. I would like to ask Mr. Gifford if he ever has made any estimates on the average line loss, taking it right through the heating season. The maximum capacity is used only a very few days in the year.

MR. GIFFORD: The percentage I gave, 1%, was on the maximum capacity of the mains and, of course, is a condition, as I said, very seldom attained. I find that the average is from 10% to 12% line loss.

MR. POWELL: Let me ask you, Mr. Gifford, what depth your main is laid on that 12% loss?

MR. GIFFORD: About 3 or 4 ft.

MR. BISHOP: Have you any tabulation as to the percentage of loss by leakage and stealage in your make-up water?

MR. GIFFORD: We have had pump counters on our make-up pump, but as to figuring it out on a percentage basis, I have never done that.

MR. BISHOP: I have in mind now a paper written by a man from Wisconsin who had a hot water plant running and who found his stealage loss higher than his leakage. It was very high. I recall the humor put into the situation afterwards by someone asking him how he tried to overcome that. He said that he conceived the scheme, in order to prevent stealing, of coloring the water. So he put a red analyne dye in the water. The fellow that was using it in preference to buying city water for his own uses, if he bathed in it, came out as an Indian, and if he washed his clothing in it, he had a red shirt to wave. He said that it did not work out as he wished because, after he had done that, a fellow in a 4-story building had a leak in the radiator and the water, running down on the ceiling below, produced a most beautiful sunset effect. When he got through with the fellow it had cost him $400 for decoration. That was not all. A lot of radiators began to leak that never had leaked and never would have leaked. The question there was a serious one to him as to the amount of new water he had to have. Have you any compilation as to that percentage?

MR. GIFFORD: I have no percentage figures. We do not have much trouble with our make-up water. I have never known of but one case where it was taken away from us. We found in that case that a mason, doing work in the basement used the warm water for his cement. But there was so much grease in the water that his cement soon fell apart. If they do use it, they will soon throw it away, for after it has circulated awhile the odor is simply terrific. I suppose it is due to sediment in the water and the use of it over and over again. The leakage in a hot water plant ought to be comparatively nothing. Of course, there is some. If it continues any length of time, it is a case of locating the leak.

MR. SPENCER: It seems to me that Mr. Gifford's figures certainly are under the most favorable conditions. I might say that we got very favorable estimates on our

plant before we began operation, and when we got into it, we found lots of things they had not thought of before.

In the first place, we could not get the radiation on a given length of distribution system that we thought we could. Instead of filling up with a compact distributing system we had to make a number of extensions. That was one thing that increased our investment expenses, a far greater distribution system than we had estimated.

Our operating expenses were also underestimated. This price of coal which Mr. Gifford gives, $1.50, if that includes handling and all, would be low. Ours costs $2.50. I know of another system that pays $2.00 without the handling. That would increase your cost. The investment per square foot of radiation is certainly much lower than ours in Detroit, at least, and others I know of.

In regard to the question of steam losses, as Mr. Lewis says, you would only get these low losses in case you could get a 24-hour full load, but when you keep on for several months and some of that time with practically no load, your expenses go up.

MR. LEWIS: Regarding the question I asked Mr. Gifford concerning line losses, it was because of some experiments we had made, where we checked up everything, and we could not figure that we have less than 15% loss average, and we have a suspicion that it runs 2% or 3% more than that.

Tests of Cast-Iron Hot Blast Heaters

New Methods of Testing and a New Formula Designed to Cover All Hot Blast Heating Conditions

BY L. C. SOULE

Editor's Note:—The accompanying article has been prepared from a paper read by Mr. Soule at the recent semi-annual meeting of the American Society of Heating and Ventilating Engineers.

The object of this paper is to describe exhaustive tests conducted last winter on six cast iron blast heaters at Buffalo, N. Y. All of these heaters were of the same general pattern but differed in the proportion of free air space to heating surface in a stack and in the proportion of free air space to the face of the heater. These tests covered velocities of air through the heaters ranging from 50 ft. per minute to 2,500 ft. per minute. Velocities were derived from actual air measurements with a manometer, and these velocities checked within an average of 2% with the velocities calculated from the amounts of condensation weighed. The tests also covered heaters ranging in depth from one to seven stacks, and various pressures of steam were used. The outside air during these tests was near the zero mark.

The results of these tests were incorporated in a mathematical deduction, which, for the first time, properly represents the theory of convection of heat. Former comparisons, made from only one or two sets of conditions, have all been more or less approximate. The majority of the data now published on blast heaters covers their performance under certain conditions of steam pressure with air entering at 0° F. A few charts show results with air entering the heater at 30° below zero. To determine the performance of a heater with air entering at other temperatures than 0°, it has been the custom to make a compari-

son either of the difference in temperature between steam and entering air, or else the differences in temperature between the steam and mean temperature of the air passing through the heater. The mathematical deduction above referred to is based on calculus, and the results

FIGS. 1 AND 2—TYPE OF CAST-IRON HOT BLAST HEATER USED IN TESTS

from these new tests were incorporated in the mathematical deduction.

DESCRIPTION OF APPARATUS

The heater referred to in this paper is made of sections having cored diamond-shaped projections on each side, as shown in Figs. 1 and 2. The sections are fastened together in stacks by right and left hexagon nipples at top and bottom The length of the nipple determines the amount of free area in the heater. The three different nipples used give 44%, 50% and 37% of free area to the face of the heater.

A complete testing plant was erected. Steam was generated in a cast iron sectional boiler under a pressure ranging from 10 lbs. to 30 lbs. pressure. Steam was supplied through a 3-in. main leading from an adjoining building through a special reducing-pressure valve to a 5-in. main to which each of the stacks of heater was connected by a flanged nipple. A steam separator was inserted in the 3-in. line in front of the reducing-pressure valve.

The air was drawn through the heater by a No. 8 Sirocco fan driven by a 10 H. P. belted motor. The motor ran at a constant speed, and but two different pulleys were used on the fan shaft. The air volume was absolutely controlled by adjusting two dampers in the main discharge pipes from the fan. It was found that by adjusting these dampers and using only two different pulleys on the fan, the velocity of air through the heater could be regulated to any desired amount.

Referring to Fig. 3, the fresh air is taken in through the opening D provided with a shutter, and passes through the connection E, which is provided with deflector plates to give an even flow of air to the heater. It then passes through the heater M, which is provided with a removable jacket. The air then

passes through a cone and then through a 36-in. diameter pipe 6 ft. long, into the fan inlet connection. The sheet iron cone and 36-in. diameter pipe are covered with hair felt 1 in. thick, since the final temperature of the air is taken at G. At this point were five chemical thermometers for measuring final temperatures, same being located at top, center, bottom and each side of the 36-in. diameter pipe. Readings were taken every 15 minutes, and each test was one hour long which gave a final temperature equal to the average of 20 readings. It was found by actual test that these thermometers were too far away from the heater to be affected by radiant heat. Two fresh air thermometers are located at B, and are protected from radiant heat by one-half round asbestos pipe covering. It was found that on an average thermometer B, nearest the windows, read 2° lower than thermometer B on the front side of the fresh air connection E. This is due to the absorption of heat from the testing room itself, the higher temperature on the front side being caused by the larger surface exposed. An opening was provided at A for recirculating the air.

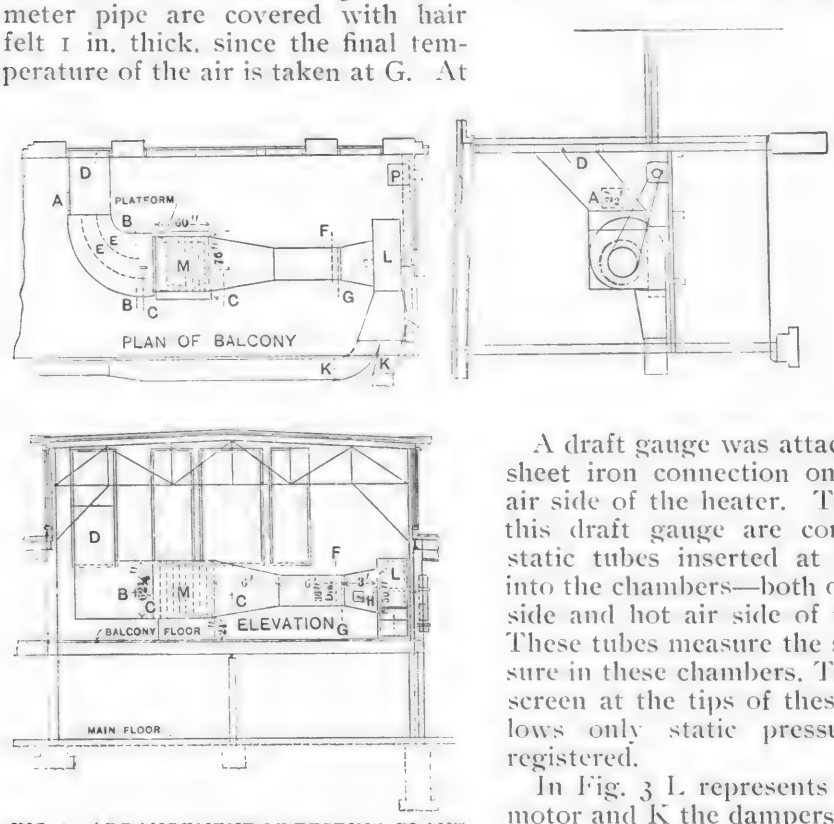
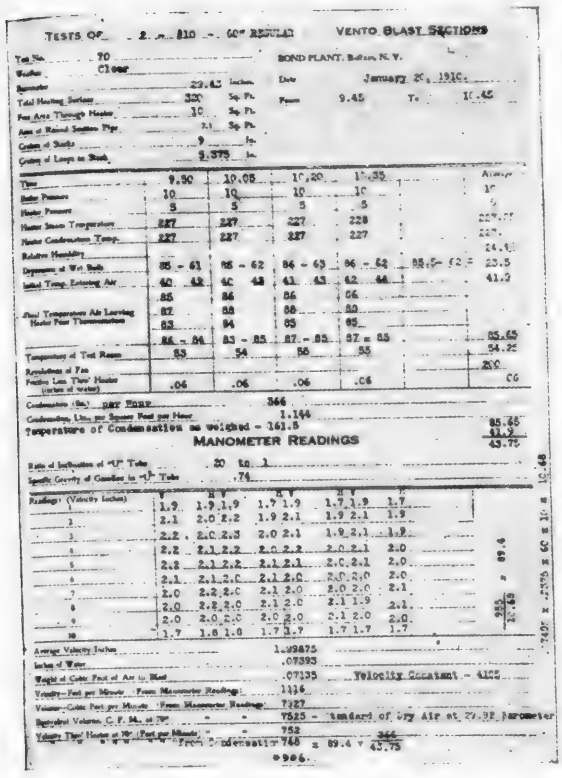


FIG. 3—ARRANGEMENT OF TESTING PLANT

A draft gauge was attached to the sheet iron connection on the fresh air side of the heater. The ends of this draft gauge are connected to static tubes inserted at C, Fig. 3, into the chambers—both on fresh air side and hot air side of the heater. These tubes measure the static pressure in these chambers. The window screen at the tips of these tubes allows only static pressure to be registered.

In Fig. 3 L represents the fan, P motor and K the dampers in the discharge pipe from fan. At H is located an opening into which a pane of window glass is inserted. Just inside of this opening is hung a wet and dry bulb thermometer, which measures the percentage of moisture in the blast of air passing into the fan inlet.

Full-sized 2½-in. returns are taken out of each stack and dropped down, in one case, through 2-in. connections into a 3-in. header, and, in another case, through 1½-in. connections into a 2½-in. header. Two return pipes were placed, one along the balcony floor and the other about 2 ft. 6 in. above the floor, both connected to the return header. When running the heater by gravity, the valve on the return line near the heater is open and the condensation flows back to the boiler through the return pipe along the balcony floor. In this case the pressure-reducing valve is


TESTS OF ... 2 ... 810 ... 60" REGULAR VENTO BLAST SECTIONS

BOND PLANT, Buffalo, N. Y.

Test No. 70
Weather Clear
Barometer 29.45 Inches
Total Heating Surface 330 Sq. Ft.
Fan Area Through Heater 10 Sq. Ft.
Area of Round Section Pipe 7.1 Sq. Ft.
Grates of Stacks 9 In.
Grates of Loops on Stack 9.375 In.

Date January 25, 1910
From 9.45 To 10.45

					Average
Time	9.50	10.05	10.20	10.35	
Boiler Pressure	10	10	10	10	10
Heater Pressure	5	5	5	5	5
Heater Steam Temperature	227	227	227	228	227.25
Heater Condensation Temp.	227	227	227	227	227.
Relative Humidity					24.0
Depression of Wet Bulb	85 - 61	85 - 62	86 - 63	86 - 62	85.5 - 62.0 = 23.5
Inlet Temp. Entering Air	60 62	60 63	61 63	62 64	61.2
Final Temperature Air Leaving Heater Four Thermometers	85	86	86	86	
	87	88	88	89	
	83	84	85	85	
	86 - 84	85 - 85	87 - 85	87 = 85	85.65
Temperature of Test Room	55	54	56	55	54.25
Revolutions of Fan					200
Positive Loss Thro' Heater (inches of water)	.06	.06	.06	.06	.06

Condensation (lbs.) per Hour ... 366
Condensation Lbs. per Square Foot per Hour ... 1.144
Temperature of Condensation as weighed - 161.5 ... 85.65 / 41.9 / 43.75

MANOMETER READINGS

Ratio of Inclination of "U" Tube ... .20 to 1
Specific Gravity of Gasoline in "U" Tube ... .74

Readings (Velocity Inches)							
1	1.9	1.9	1.9	1.9	1.9	1.9	1.7
2	2.1	2.0	2.2	1.9	2.1	1.9	2.1	1.9
3	2.2	2.0	2.3	2.0	2.1	1.9	2.1	1.9
4	2.2	2.1	2.2	2.0	2.2	2.0	2.1	2.0
5	2.2	2.1	2.2	2.1	2.1	2.0	2.1	2.0
6	2.1	2.1	2.0	2.1	2.0	2.0	2.0	2.0
7	2.0	2.2	2.0	2.1	2.0	2.0	2.0	2.1
8	2.0	2.2	2.0	2.1	2.0	2.1	1.9	2.1
9	2.0	2.0	2.0	2.0	2.0	2.1	2.0	2.0
10	1.7	1.8	1.9	1.7	1.7	1.7	1.7	1.7

Average Velocity Inches ... 1.98875
Inches of Water ... .07393
Weight of Cubic Foot of Air in Heat ... .07135 ... Velocity Constant = 4125
Velocity—Feet per Minute (From Manometer Readings) ... 1136
Volume—Cubic Feet per Minute (From Manometer Readings) ... 7327
Equivalent Volume, C. F. M., at 70° ... 7525 - Standard of Dry Air at 29.92 Barometer
Volume Thro' Heater at 70° (Feet per Minute) ... 752
From Condensation 748 x 89.4 x 43.75 ... 366
.906

FIG. 4—SAMPLE TEST SHEET

blocked open. During a test, however, the pressure-reducing valve operates as desired, and the valve, near return header on the gravity return line, is closed and condensation passes through the upper return line and into the steam jacketed tank. This tank is about 2 ft. in diameter by 3 ft. high, and there is a 2-in. jacket space around inner chamber. This arrangement of return connections forms a water seal, which prevents steam from any one heater stack backing up through the return into any other stack. To prevent the water being blown out of this seal when drawing off condensation during a test the same pressure is maintained in this steam jacketed tank as in the steam header by an equalizing pipe. The condensation is handled as in a boiler test. The amount of condensation, at the end of a half hour is taken, and this amount is checked up with the amount for the next half hour.

The entire sheet iron work from the fresh air inlet to the fan is made air-tight, as the air is measured on the suction side of the fan.

ENTERING AIR TEMPERATURE TAKEN NEAR HEATER

In former tests the entering air temperature was taken by a thermometer hung outside the building, whereas the entering air temperature on these tests was taken near the heater. The manometer for measuring the air velocity pressure is located at F, Fig. 3. This manometer measures the pressure due to velocity of air passing that particular point. The area of the pipe at this point is accurately determined. The temperature of air at this point is determined and the weight of air at this temperature taken from a table and corrected for humidity and barometer. From this corrected weight of air and the velocity pressure, the velocity passing point F, Fig. 3, is determined; also the volume. This volume is then reduced to a standard of dry air at 70° and barometer 29.92 in. This volume, divided by the free area through the heater, gives the velocity through heater in feet per minute, at the 70° standard. This is all shown on sample test sheet in Fig. 4. The velocity is then figured from the condensation and tempera-

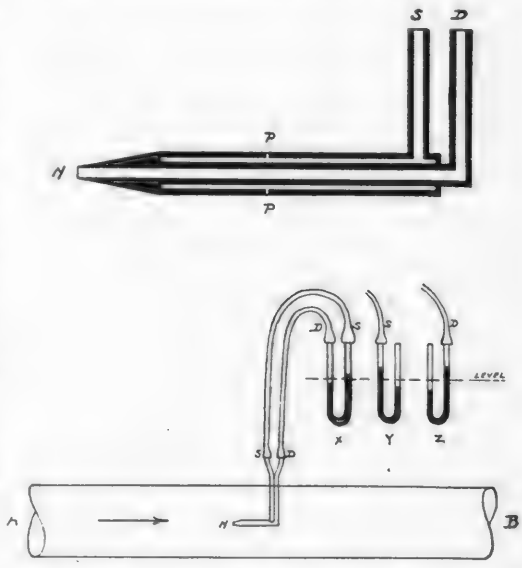


FIG. 5—MANOMETER USED IN TESTS

ture raise, and these two velocity figures check within an average of 2%. In the particular test sheet illustrated in Fig. 4, the velocity from manometer reading was 752 feet per minute, and figured from condensation was 748 feet per minute. The manometer used is shown in Fig. 5.

RESULTS OF TESTS

In order to properly represent the temperature increment due to the air passing over any depth or amount of heating surface, it is necessary to derive a formula based on calculus. In Fig. 6 the top line represents the temperature of the heater. The ordinates represent temperatures and the abscissæ, distances along the hot surface. Any one of these curved lines represents the temperature of the air as it increases by prolonged contact with the heater. As the air, at a lower temperature than the steam passes along the hot surface, it gradually becomes warmer—approaching nearer and nearer to the temperature of the steam—reaching this limit when the air has passed over an infinite length of this hot surface. It will be seen from Fig. 6 that any one of these curved lines will become tangent to the top line at an infinite distance. In this sketch t represents the temperature difference between the steam and air at any point, ds equals surface of heater, where the temperature difference is t, dt represents the temperature raise corresponding to ds.

It is necessary to deduce the equation of this curve for various velocities of the air.

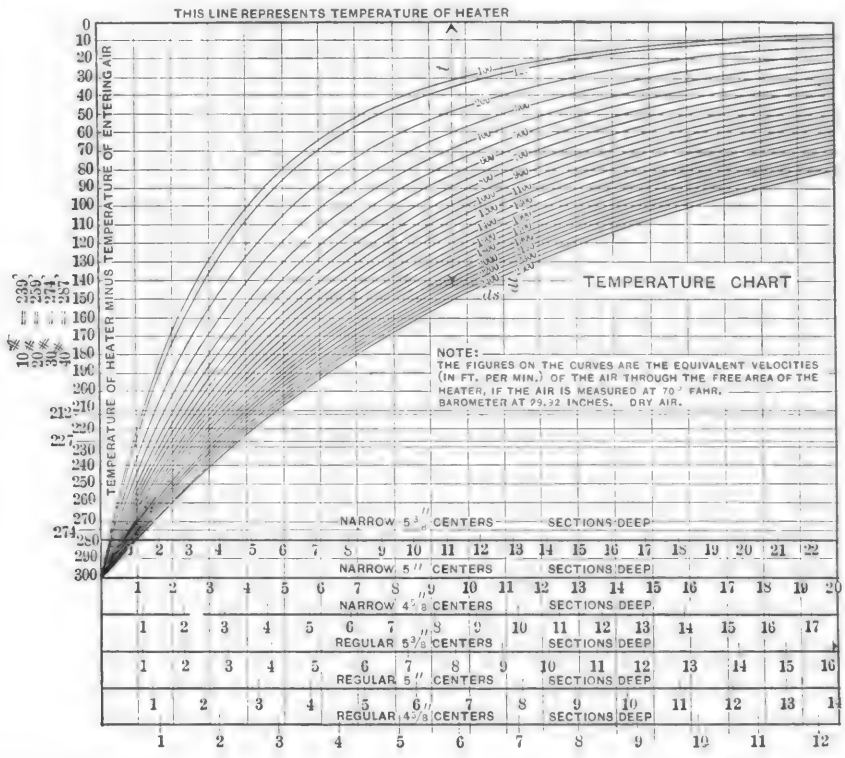

THIS LINE REPRESENTS TEMPERATURE OF HEATER
TEMPERATURE OF HEATER MINUS TEMPERATURE OF ENTERING AIR
TEMPERATURE CHART
NOTE:
THE FIGURES ON THE CURVES ARE THE EQUIVALENT VELOCITIES (IN FT. PER MIN.) OF THE AIR THROUGH THE FREE AREA OF THE HEATER, IF THE AIR IS MEASURED AT 70° FAHR. BAROMETER AT 29.92 INCHES. DRY AIR.
NARROW 5 3/4" CENTERS SECTIONS DEEP
NARROW 5" CENTERS SECTIONS DEEP
NARROW 4 3/8" CENTERS SECTIONS DEEP
REGULAR 5 3/8" CENTERS SECTIONS DEEP
REGULAR 5" CENTERS SECTIONS DEEP
REGULAR 4 5/8" CENTERS SECTIONS DEEP

FIG. 6—TEMPERATURE CHART, SHOWING RISE IN TEMPERATURE DUE TO AIR PASSING OVER VARIOUS DEPTHS OR AMOUNTS OF HEATING SURFACE

The mathematical formula used for this purpose was deduced by L. A. Cherry, of Vanderbilt University. This formula makes use of previous formulæ deduced by well-known authorities, as follows:

Years ago Dulong and Petit de-

vised a formula to represent the quantity of heat lost from a unit area by a hot body in a given time. This

As R (the radiant heat) has no perceptible influence on warming the air passing over the surface, the

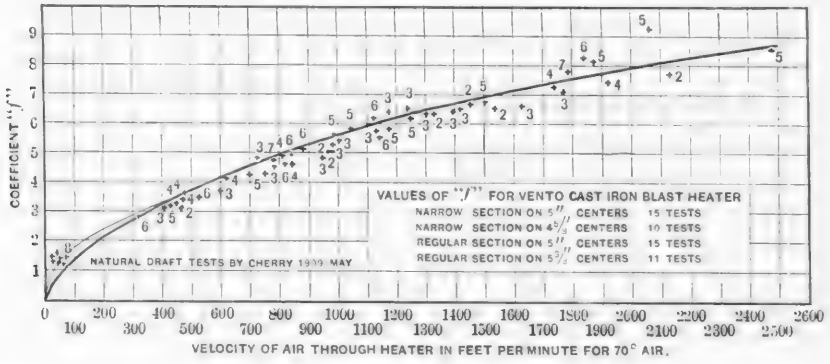

COEFFICIENT "f"
VALUES OF "f" FOR VENTO CAST IRON BLAST HEATER
NARROW SECTION ON 5" CENTERS 15 TESTS
NARROW SECTION ON 4 5/8" CENTERS 10 TESTS
REGULAR SECTION ON 5" CENTERS 15 TESTS
REGULAR SECTION ON 5 1/8" CENTERS 11 TESTS
NATURAL DRAFT TESTS BY CHERRY 1909 MAY
VELOCITY OF AIR THROUGH HEATER IN FEET PER MINUTE FOR 70° AIR.

FIG. 8—COEFFICIENT CHART FOR DIFFERENT VELOCITIES OF AIR PASSING THROUGH HEATER

quantity of heat is a combination of amount lost by radiation and amount lost by convection. The amount lost by convection

$F = Bh^{c} (T - \theta)^{1.233}$, where

B is a coefficient which depends on the form and dimensions of the surface.

T, the temperature of the hot body;

θ, the temperature of the surrounding gas;

quantity F is the controlling factor.

The above equation of F was quoted by Rankine.

The formulæ for R and F were simplified by Peclet, and afterwards verified by Ser. The value of F was as follows:

$F = 0.552$ f.S. $(T - \theta)$ 1.233.

This value of F is quoted by Carpenter, page 83.

S. represents the surface of the body and f the coefficient of convec-

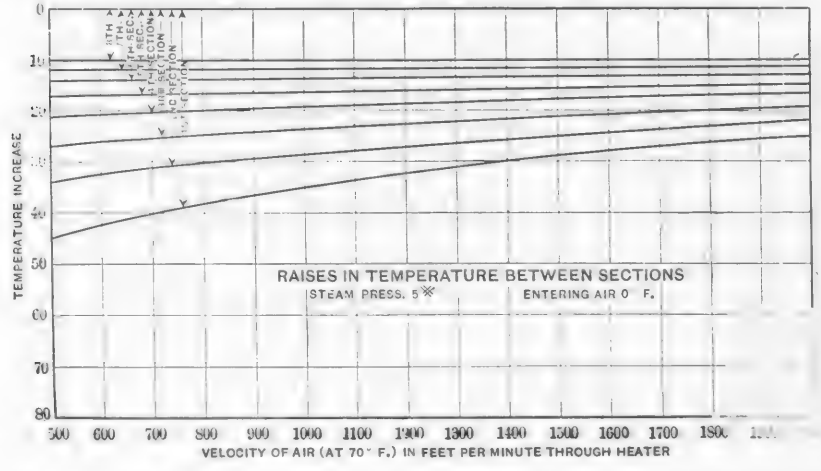

TEMPERATURE INCREASE
RAISES IN TEMPERATURE BETWEEN SECTIONS
STEAM PRESS. 5#
ENTERING AIR 0° F.
VELOCITY OF AIR (AT 70° F.) IN FEET PER MINUTE THROUGH HEATER

FIG. 8—RAISES IN TEMPERATURE BETWEEN STACKS OF HEATER UNDER ONE SET OF CONDITIONS

h, the pressure of the surrounding gas;

c, a number which depends on the nature of the gas.

tion. The values of f are shown as ordinates in Fig. 7.

MR. CHERRY'S FORMULA

Mr. Cherry's value of f. as ap-

plied to these particular tests, is as follows:

$$f = \frac{0.2375}{0.4814 \times 0.233} \times \frac{W}{S} \times \frac{1}{t\ 0.233} \frac{t_s}{t_o}$$

$$= 2.118 \frac{W}{S} \frac{1}{t\ 0.233} \frac{t_s}{t_o}$$

Where W = weight (in pounds) of air passing over surface per hour.

Now W = v x A x 60 x 0.07495.

Where v = velocity of air through heater in feet per minute measured at 70°.

A = "free area" of heater in square feet.

0.07495 = weight of one cubic foot of air at 70° F.

Also—

S = s x b x d where

s = sq. ft. of heating surface per section;

b = width of heater in sections;

d = depth of heater in sections.

The various values of t s represent the difference between temperature of steam in the heater and the final temperature of the air leaving the heater. Similarly the values of t o represent the difference between the temperature of steam in the heater and the temperature of the air entering the heater.

Solving for f with the values taken direct from the tests, we determine points, as shown in Fig. 7, from which we construct the coefficient curve as shown. It will be noted that each one of these points along this curve represents a test of one hour's duration. Seventy-one tests were made, at varying velocities and with various numbers of stacks in depth, with various free areas and steam pressures, and with the air entering the heater at whatever outside temperature was available. Eight previous tests made on this heater under natural draft conditions were plotted on this same coefficient chart, the velocities ranging from 34 ft. per minute to 77 ft. per minute. It made no difference regarding the number of stacks deep

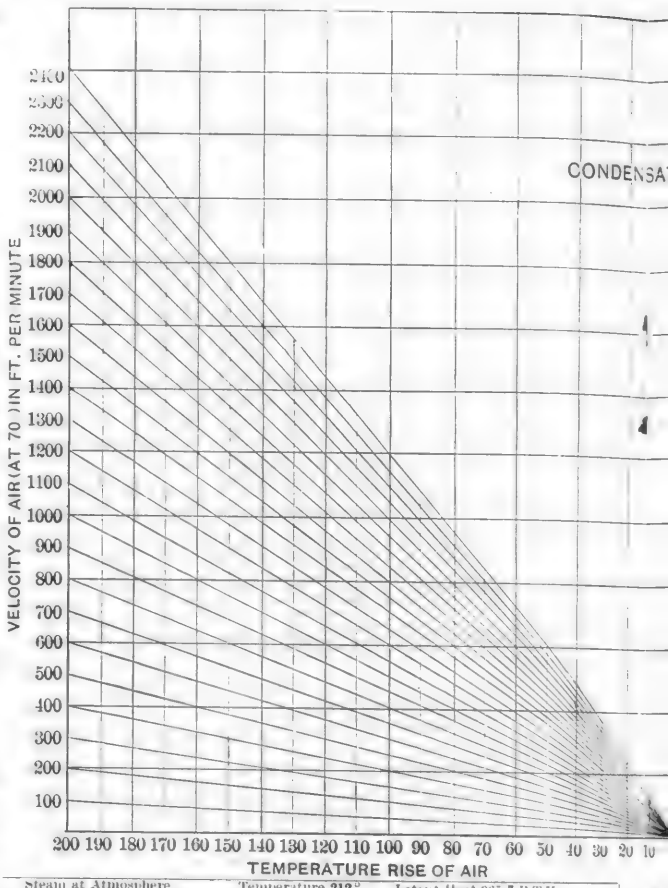
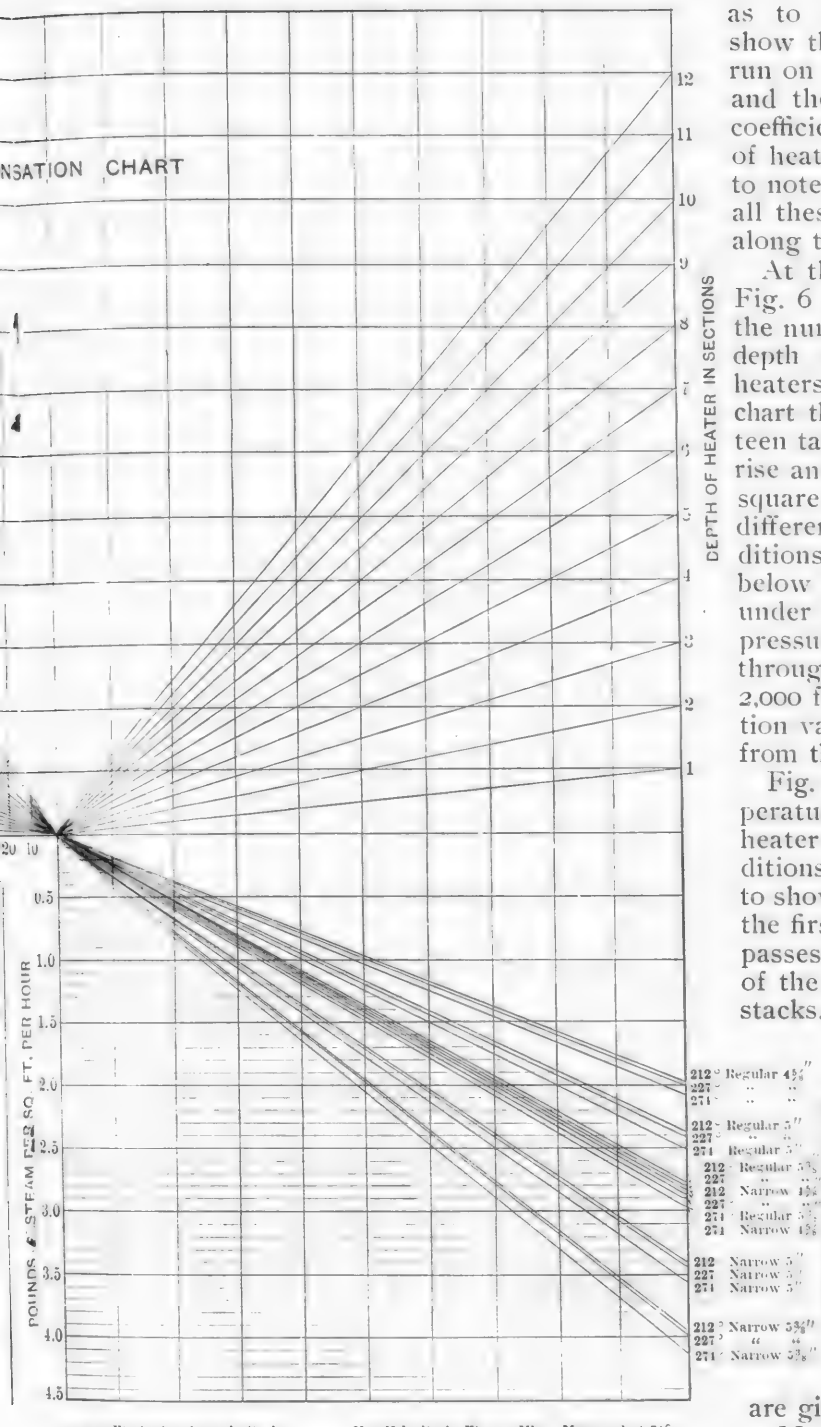


FIG. 9—CONDENS



S = Sq. Ft. Surface in each Stack
D = Depth of Heater in Sections
L = Latent Heat of Steam
V = Velocity in Ft. per Min. Measured at 70°
A = Free Area through Heater in Sq. Ft.
T = Temp. Rise of Air

CONDENSATION CHART

as to its coefficient. These tests show that a series of tests could be run on a heater of one certain depth and the values determined by this coefficient chart for any other depth of heater. It is of especial interest to note that these test points, under all these varying conditions, follow along this same coefficient line.

At the bottom of chart shown in Fig. 6 the six horizontal lines with the numbers thereon indicate the depth in stacks of six different heaters. From this temperature chart there have been prepared fourteen tables showing the temperature rise and condensation in pounds per square foot per hour for these six different heaters under various conditions of air entering heater, both below zero and above zero, and under varying conditions of steam pressure and with velocities of air through heater ranging from zero to 2,000 ft. per minute. The condensation values in these tables are taken from the chart shown in Fig. 9.

Fig. 8 shows the raises in temperature between stacks of this heater under one certain set of conditions. The object of this chart is to show the greater heating effect of the first stacks over which the air passes as compared with the effect of the air passing over the last stacks. This chart is made up from chart in Fig. 6, and shows the regular increase in temperature at varying velocities. Special attention is directed to this chart, as previous blast heater charts, if plotted in this way, would show very irregular curves.

Fig. 10 shows the friction loss in inches of water due to the air passing through three of these heaters having different free areas, and the values are given for any velocity of air.

Mr. Cherry applied his formula to one heater only, operating under one steam pressure, but the writer has shown that this formula applies to heaters having various free areas and to heaters of varying depth of section corresponding to 2-row and

4-row pipe coil sections; also that it applies to different steam pressures. conditions; and the writer's personal superintendence of these tests al-

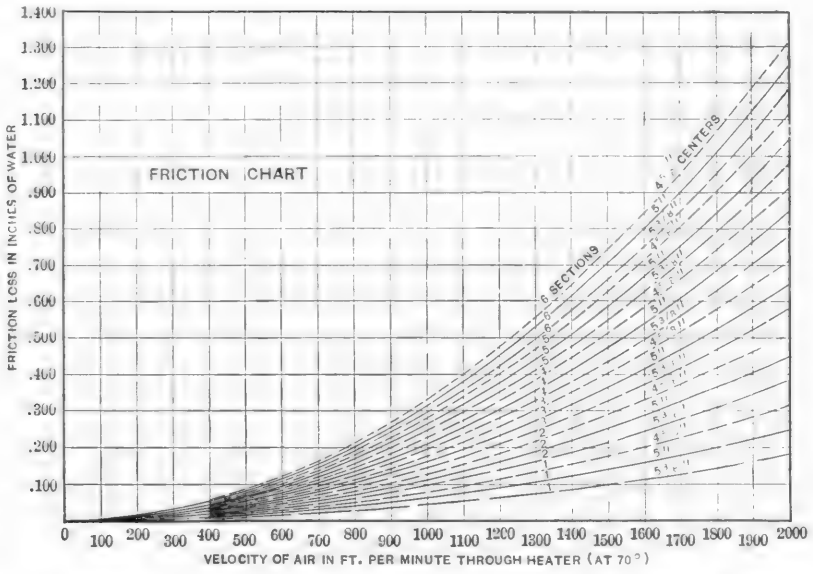


FIG. 10—FRICTION LOSS IN INCHES OF WATER DUE TO AIR PASSING THROUGH HEATERS

The data which has been compiled by the writer from these tests and this mathematical formula is intended to cover all blast heating lowed him to obtain such results, it is thought, as have been desired for some time past by engineers of this profession.

Ventilation in Its Relation to Health

By William G. Snow.

In connection with the crusade that is being carried on in many parts of the country by heating and ventilating engineers to educate the public to a proper appreciation of the necessity for adequate ventilation of their public and other buildings, including their homes, the following, taken from a lecture delivered by William G. Snow at Cornell University last May, forms a careful review of the subject that will prove interesting reading to the engineer and layman alike. Mr. Snow's lecture was delivered in the course on Sanitary Science and Public Health, in co-operation with the New York State Department of Health:

"While it is admitted," said Mr. Snow, "by all thinking people that ventilation must promote health, it is not realized to what extent the converse of this statement is true; that is to what extent ill health is caused by insufficient or ineffective ventilation."

Macfie, in his recently published work, "Air and Health," says:

"Air containing merely the CO_2 and moisture usually contained in vitiated air will not produce the effect of vitiated air, and vitiated air, therefore, must contain an additional constituent. This additional constituent, though undetected by chemists, is probably detected by the nose, for it is well known that air is oppressive and harmful not so much in proportion to the amount of CO_2 and moisture it contains as in proportion to its *smelliness*. The very fact that the

nose is so sensitive to such odors would seem to suggest their harmfulness."

In addition to the carbonic-acid gas, the effluvia and the humidity mentioned, which affect the comfort and well-being of persons, are the dusts to which Dr. T. Mitchell Prudden's little book "Dust and Its Dangers" is devoted.

Outer air contains, of course, more or less dust which when admitted to a building tends to settle. Dr. Prudden observes that even *ordinarily efficient* systems of ventilation do not carry off any considerable proportion of the dust particles from closed still rooms . . . and when by a system of *forced* ventilation we cause large volumes of dust-laden air from out-of-doors to pass through them, we are actually, so far as micro-organisms are concerned, cleansing the air and sending it out much freer from germs than when it entered, these having slowly settled as the air makes its way from the entrance to the exit of the ventilating openings." He says:

"When we consider the comportment of dust particles in closed rooms, we see at once that the great renovating and cleansing agencies which are so efficient out-of-doors are, except on special occasions, absent, namely, the winds and strong air currents and the more or less frequent and prolonged wettings. . . . A rainfall, to a certain extent, tends to free the air of its germs by washing them down. . . ."

Dr. Prudden points out that:

"We should always remember that bacteria do not become detached from the surfaces or materials on which they grow or are lodged while these are in a *moist* condition. . . . ."

The most obvious means to prevent the accumulation of dust within enclosures is to remove it from the entering air.

EFFECT OF FOUL AIR ON HEALTH AND COMFORT

While the harmful effect of foul air may not be immediate further than its effect on one's comfort or mental acuteness, it is generally conceded that frequent and protracted exposure to such air, as in the case of poorly ventilated school buildings, results physiologically in a lowering of the vitality of the occupants, rendering them more susceptible to disease and considered economically results in a lessened efficiency on the part of both pupils and teachers.

Playfair asserts that, in modern hygiene, 'nothing is more conclusively shown than the facts that vitiated atmospheres are the most fruitful sources of disease."

Tuberculosis and pneumonia are most prevalent among persons living or working in unventilated rooms. These diseases are caused by specific bacteria which, for the most part, gain access to the air passages by adhering to particles of *dust* which are inhaled. To bad air we attribute much of the anaemia, the pallor, the neurasthenia, the general ill-health of slum dwellers and factory workers and most persons engaged in sedentary indoor occupations."

As to the effect of dust, Mr. Prudden says:

"Very moderate amounts of dust particles in sensitive persons cause such a degree of irritation of the respiratory organs as either to deprive them of robust health or predispose them to the acquirement of various diseases which with unirritated lungs they would readily resist.

"As to the bacteria . . . there are unfortunately a few species which, when they once find lodgment in one place or another in the organs of respiration, may grow and multiply, and successfully resisting all the protective agencies of the body, set up distinct, persistent and even fatal disease. These forms of bacteria which can or in these regions commonly do this, are insignificant in number in comparison with the harmless species with which dust is usually swarming. But few as they are they have an extreme significance. If it were not for these few species of disease-producing bacteria people could perhaps afford to be as indifferent as they are to dust and its dangers. . . ."

(*To Be Continued*)

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THE HOTTEST July on record, with one exception, in New York City has given New Yorkers an excellent opportunity of appreciating the atmospheric conditions that can be attained in the city's subway. Interesting comparisons are also possible with the ventilation of the Hudson River tunnels where the difficulties of furnishing a supply of fresh air are obviously much greater. While the Hudson River tubes are able to maintain a temperature at, if not below, the outside temperature, the city's subway is so noticeably hot and stuffy as to cause general comment.

Of course, the superior ventilation secured under the river is concededly due to the separate tube construction, resulting in a very decided piston action of the trains on the air. There is nothing new, however, in this method of ventilation and it may well be pointed out that long before the subway was built and repeatedly during its construction the need of partitions separating the tracks was dwelt on and urged at much length by many of the engineering profession. That it has not been done is probably no fault of the Interborough's engineers, but the expedients that have been resorted to to solve the problem, including the use of louvres and recirculating fans, are perhaps the most interesting monuments of inefficiency now standing to the discredit of the ventilating profession. Meanwhile a long-suffering public continues to stifle and swelter and the company continues to postpone what would seem to be the inevitable remedy.

SUCH WEATHER as the eastern portion of the country has experienced during the past month has brought into sharp relief the slight progress that has been made in improving conditions in buildings due to excessive temperatures. In a restricted class of structures the cooling effects obtained by air washers were so noticeable as to call forth comment from the daily papers, but in the great mass of commercial buildings the absence of any adequate cooling arrangements was as marked as in the days of the most primitive construction. While no city reported any record-breaking temperatures, the figures in New York alone showed a mean temperature for the month of 78° which, with the exception of 1901, has never been equaled in the 40 years of the local weather bureau. In addition to this, the precipitation was 0.23 in., nearly an inch less than that for any previous July.

MECHANICAL EQUIPMENT

A Large Central Cooling Plant and Brine Distributing System

On account of the softening of cocoa and chocolate at comparatively low temperature, in order to work it successfully it is necessary to use artificial refrigeration both for cooling the chocolate liquors and for cooling the rooms where certain operations take place. The question of cooling is therefore one of vital importance.

The Walter Baker plant in Dorchester, Mass., was founded about 1780 and, as is usual with a plant that expands gradually over a long period of time, the buildings are much scattered and each mill was a unit in itself. About four years ago the management decided that large economies in the manufacturing operations could be effected by building a large central power plant, and at the same time it occurred to them that similar economies could be effected by centralizing the refrigerating apparatus.

It was decided to install a central cooling plant and distribute brine through thoroughly insulated pipes to various parts of the factory. The plant was designed to maintain continuously its highest efficiency with the least attendance and repair expense. It consists of a central cooling station capable of containing six 100-ton ammonia absorption refrigerating machines.

Three machines were installed first, and these have now been running successfully for about three years. The building selected was formerly the power house of the Baker mill and is located on the banks of the Neponset River up stream from the rest of the plant, except the new central power plant, which adjoins it immediately up stream.

The refrigerating machines are the Pontifex Hendricks absorption type, operated either with exhaust or reduced pressure steam. All the units, piping etc., are laid and keeping in view the ultimate capacity of 600 tons of refrigeration per day.

In addition to these machines the plant consists of the brine circulating, brine cooling, ammonia generating and condensing, the water circulating and the steam condensing units. All pumps are installed in duplicate. The circulating medium is a calcium chloride brine of 1.24 specific gravity, which leaves the machines at a temperature of —10° F. and returns at a temperature never above zero.

This brine is circulated to the various parts of the plant where required for the cooling of chocolate liquors or for cooling rooms where the chocolate is being manipulated. The indirect system of refrigeration is used throughout, no piping being placed in rooms having either occupants or manufactured products. The system requires very complete and careful insulation of the transmission pipe lines.

Except for the mains running in the subway leading from mill No. 4, the Baker Mill, to mill No. 1, the Pierce Mill, a distance of about 200 ft. under a street, the pipes are insulated with 3 in. of hair felt, canvas jacketed and painted. In the subway they are insulated with 3 in. of Nonpareil cork, painted with rubber cement and the pipes hung with special supports outside of the insulation. The accompanying figures

DOUBLE DUCT AIR SUPPLY FOR BLOWING AIR OVER BRINE COOLED COILS IN BUNKER ROOM, PLANT OF WALTER BAKER & CO.

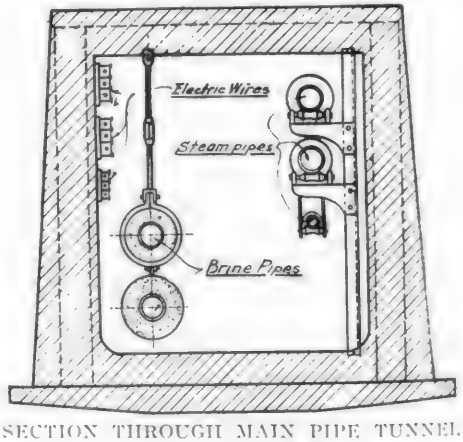
show the two methods of insulation.

The cooling of the various rooms is effected by blowing air around coils in which the brine is circulated and located in bunker rooms. There are over 40,000 lin. ft. of 2-in. galvanized pipe in the various bunker rooms and a total fan capacity of about 165,000 cu. ft. of free air per minute. The largest cooling capacity of any single room is 2½ tons of chocolate per hour.

The walls and roof are sheathed with 3-in. tongue and grooved plank, which is lagged on the inside with a double layer of sheet cork, each layer 2 in. thick. The walls and ceiling are then plastered with 1 in. of hard white cement plaster. There are three sash tightly fitted to each frame, with 1-in. x½-in. stop rabbeted into the side rails between each sash.

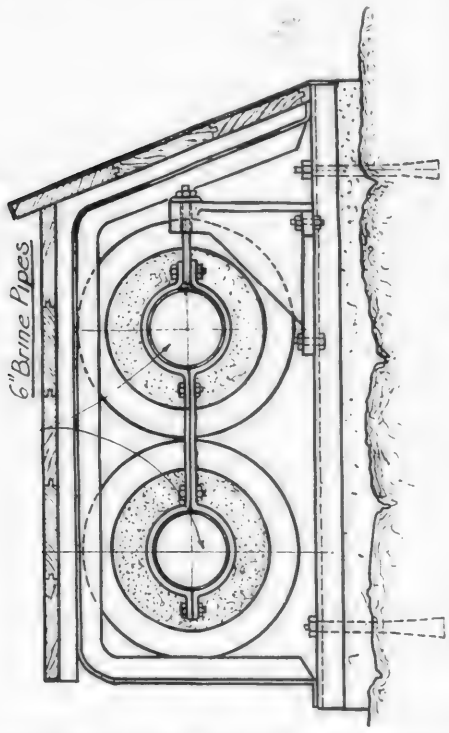
The sills are cut with a ¼-in. offset under each sash and the bottom rail of the sash is rabbeted to fit over this offset, leaving a small space which is stuffed with felt. The top rail of the frame is rabbeted ¼ in. and the sash fits tightly against this. The outside is shingled and all metal work is of 16-oz. copper.

The accompanying photograph shows the double duct air supply used for blowing the air over the brine cooled coils in connection with one of the bunker rooms. The fan draws air either from the atmosphere or from the cooling room, the pro-



SECTION THROUGH MAIN PIPE TUNNEL.

portion from each source being regulated by a damper controlled by the two chains shown in the lower right-hand corner of the photograph. The air is forced over cooling coils, the moisture being precipitated by the sudden chilling. The efficiency of the cooling and the regulation of the humidity is accomplished by varying



SECTION OF PIPE TUNNEL AT AREAWAY

the air supply as shown above and by changing the speed of the fan, which is driven by a variable speed motor developing 5 H.P. when running at 900 R. P. M.

As the space was limited for the capacity of fan required, the Squirrel Cage double width type was adopted. The fan wheel is 16 in. in diameter and 18 in. wide, with a dividing plate in the middle, to which are attached the interblades. There is an inlet on both sides of the fan 14 in. in diameter to which air is supplied by the rectangular flues as shown. The delivery is horizontal through an outlet 16½ in. x 24 in.

The adoption of refrigeration in this mill is carried to a perfection not realized in any other similar existing plant. Simplicity and effectiveness are the keynotes of the design throughout. This application of refrigeration, in addition to being a problem of cooling, led into the field of the efficient handling and manipulation of the several products. This work, together with the central power station and the electrical distribution of power, was designed and the installation supervised by F. W. Dean, mill engineer and architect, Boston, Mass. The fans installed are of the Massachusetts Fan Co. make.

CORRESPONDENCE

Vacuum Systems for Central Station Heating

EDITOR HEATING AND VENTILATING MAGAZINE:

As a recent reader of your very instructive and interesting magazine, I should be very glad if you could kindly inform me if vacuum systems of exhaust steam heating have been adopted in America for district heating, where long underground mains are required. If so, is the water of condensation returned to the central station or not?

I should also be much indebted to you if you will also kindly tell me the usual charges made by district heating engineers for the heat supplied, both in the case of water and steam plants.

F. W. RAYNES,
The Glasgow and West of Scotland Technical College, Glasgow, Scotland.

As regards vacuum systems for district heating, this would come under the head of two-pipe or return steam systems. This has not been installed anywhere that we know of until very recently.

As all steam piping has to be laid to a grade or so that any condensation can be taken care of, the topography of the district where the lines are run will have quite a governing influence on the layout.

The Toledo Railways & Light Co., of Toledo, O., states that it has a small amount of steam radiation, and two other district steam heating companies in the same city use return vacuum systems with very good results. The superintendent of heating for the Toledo Railways & Light Co. writes us: "I would, where possible, by all means put in a return pipe system, but not in all cases. There are conditions where return systems are almost imperative. One is where the heating company has to buy its water for the boilers or gets it at more

than the ordinary cost. Another is where the water is impregnated with solutions that are deleterious to boilers, such as excess of sulphates, magnesia and other solutions of that nature. Any district layout for steam heating could be arranged, at least in part, with returns with gratifying results. I would not consider a vacuum system without returns as good, because it would mean an installation in each customer's premises with some source of power to maintain it, and at best, in that event, I would let the customer do it under the company's inspection and supervision. I would add that a vacuum system with returns would mean an equipment at the station only.

"Charges for heating is a very interesting element in district heating and one that has never received the broad attention it deserves. It is the hope of the writer that the National District Heating Association will collect some data on that subject. Nearly all steam radiation is charged for by the 1,000 lbs. of condensation and varies from 30c to 70c per 1,000 lbs., depending upon conditions, fuel cost, district layout and cost, etc. A sparsely-used district with long mains for a relatively small amount of radiation will bring up the fixed or operating costs. Charges for hot water are based on the flat rate because we have no meter as yet for same. It is based on the cubic contents or square feet of radiating surface and varies from 12c to 22c per square foot per season. The writer has been at work on this problem to the end that by getting the duty from a B. T. U. basis, a corresponding result can be arrived at for all conditions. There are a few companies which charge for steam heat on a flat rate, but I would advise against it. Their charge is from 27c to 33c per square foot per season."

NEW DEVICES

A New High-Grade Valve

Arrow bronze globe, angle and cross valves are a recent addition to the already large and well-known line of extra heavy renewable valves, consisting of globe, angle, cross, check, blow-off, etc., manufactured by the Star Brass Mfg. Co., 104-114 East Dedham street, Boston, Mass. The new Arrow valve is described as of standard weight, mechanically designed correct and of full pipe size area. It is expressly designed to fulfill the existing want for a low-priced, standard-weight valve and not made for competition with the so-called competition type of valves.

The manufacturers state that the Arrow valve is carefully made of the best steam metal, all parts being absolutely interchangeable. It is made in three styles, globe, angle and cross with screwed ends. Each valve is tested to 300 lbs. hydrostatic pressure before shipment and is guaranteed absolutely tight. The enviable reputation enjoyed for the products of the Star Brass Mfg. Co. lends much interest to this latest addition to its output.

THE NEW ARROW VALVE

A Noiseless Valve for Vacuum Heating Systems

Two troubles that heretofore have been frequently encountered in the erection of vacuum steam heating systems are claimed to be done away with by the installation of the Monash radifier. One is the noise caused by the chattering of the float. The other is the fact that a valve of this type cannot be cleaned without removing it from the radiator, coils or other heating units to which it has been attached.

In the construction of the Monash radifier, as herewith illustrated, the arrow letter A points to the still body of water in which the float is incased, preventing the chattering of the float due to air or water currents. This is designed to render the valve noiseless. The arrow letter J points to the seat, which can be unscrewed and the interior of the valve taken out and thoroughly cleaned without disconnecting the valve from the radiator, coils or heating units.

The valve is attached to the return end of the radiator or heating device by the union nipple D and to the return pipe at the outlet F, which is connected to the

vacuum pump. The air and water of condensation are drawn by the vacuum from the radiator into the radifier through the inlet D past the ball check E down into the goose-neck trap, where any core sand, heavy dirt or foreign matter is deposited, which may be blown or drawn through the by-pass valve into the return through the outlet F. The air and water of condensation pass upward in chamber C, when the air separates from the water and is drawn through the chamber S and the opening O, then on to the hollow float guide pin P, through the float K down to the return through the outlet F.

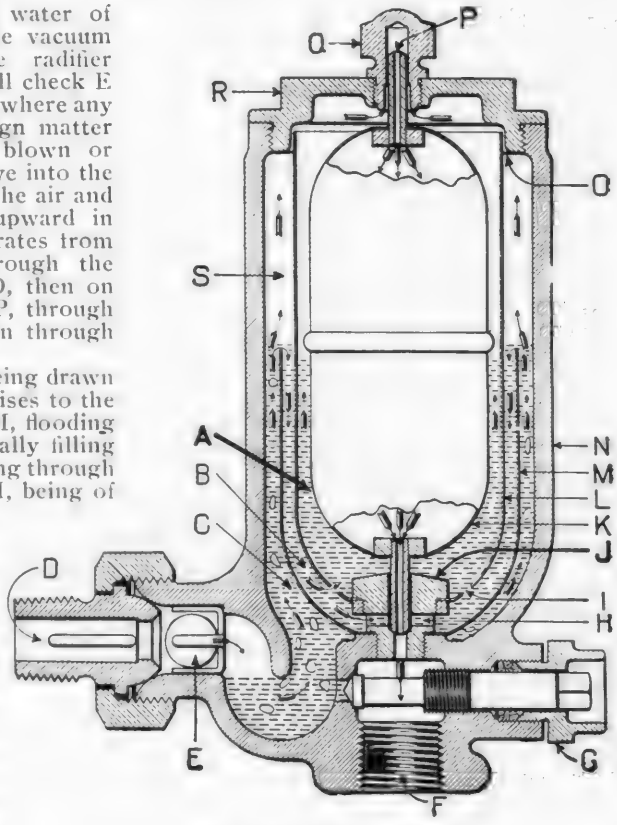
The water of condensation being drawn up into the body of the valve, rises to the upper edge of the outer shell M, flooding the chamber B and also gradually filling the chamber A by slowly passing through the opening I. The openings I, being of small dimensions, prevent the sudden rush of water into the chamber A, thus breaking the current or force of the water, preventing the chattering of the float, due to air or water currents, which is the essential feature in an absolutely noiseless float valve.

The water gradually rises around the float to a point near the seam, when it raises the float K, thereby opening the discharge passage through the valve seat J. While the valve is open, the chamber B is drained by the water passing through the opening H in the valve seat J and to the return pipe through the outlet F, and since the discharge is over the top of the shell M, the oil, grease or floating matter is skimmed and is carried off with the water.

The receding water in chamber A keeps the float buoyant until the valve is closed, thereby insuring a noiseless operation of the float. The phosphor bronze ball check E is held in place by a copper basket and seating in the union nipple prevents the vacuum in the radiator reacting on the vacuum in the return when the radiator supply valve is closed.

To clean the passageway of the float, the cap Q may be unscrewed and a wire forced through the openings in the float guide stem. To clean the valve, remove the cover R, when the float can then be taken out and with the special wrench the seat J can be unscrewed and the interior of the entire valve removed and cleaned, there being no sharp corners or hidden channels where any foreign substances could lodge.

The by-pass valve is protected by a locked shield feature G, which prevents unauthorized parties from tampering with the valve, keeping the control of the system in the hands of the proper parties.



THE MONASH RADIFIER

The Monash radifier is manufactured by the Monash-Younker Co., Chicago and New York, and sold to the trade with a perpetual license for its use.

A Steam Heating System Under Modulated Control

A seven-day test conducted last winter on a Warren Webster Modulation heating system is an office and warehouse building in Montreal, demonstrates how successfully heat can be supplied when, where and in the amounts wanted by a steam heating system in which the steam admission to each radiator is regulated and the discharge of water and air is under proper automatic control. The installation on which the test was conducted was designed by and installed under the supervision of Darling Bros., Ltd., of Montreal, sole manufacturers in Canada of the Warren Webster apparatus, and was a standard two-pipe Webster modulation system.

The test ran from a Thursday to the following Wednesday, the offices being closed all day Saturday. The building in question has a cubical contents of 120,000 cu. ft., is exposed on three sides, the total

wall exposure being 7,843 sq. ft. The roof area is 2,860 sq. ft. and the exposed glass area is 1,239 sq. ft. Because of its location in Montreal it was obviously exposed to very severe weather conditions; all windows were provided with double sash. The radiating surface was figured on the basis of steam supplied at a pressure of 6 to 8 oz., the total installed being 1,500 sq. ft.

Each radiator is equipped with a self-indicating Webster modulation inlet valve, having a figured dial conveniently located at the top on one end, with a Webster water seal motor at the return end. By the inlet valve the effective area of heating surface can be quickly changed and the temperature of the room perfectly modulated. The usual fault in steam heating systems of having the

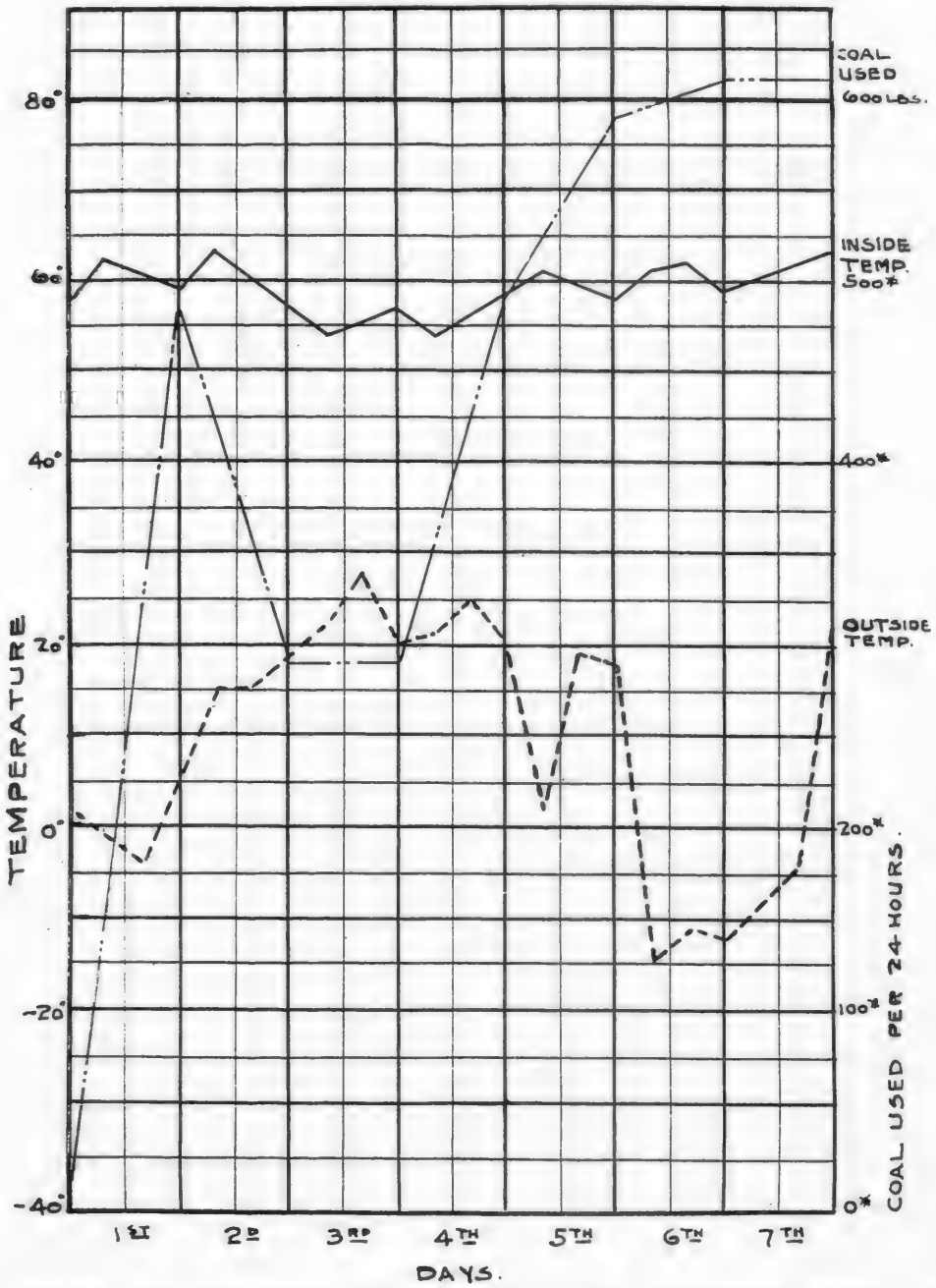


DIAGRAM OF TEST OF MODULATION HEATING SYSTEM IN MONTREAL OFFICE AND WAREHOUSE BUILDING

steam either all on or all off is thus avoided. The water seal motor, requiring no adjustment, automatically ejects water and air from the radiator without permitting the escape of steam.

How closely the temperature in a building can be controlled by the modulation system in spite of wide variations in the outside temperature is shown by curves in the accompanying plot, derived from figures obtained during the test.

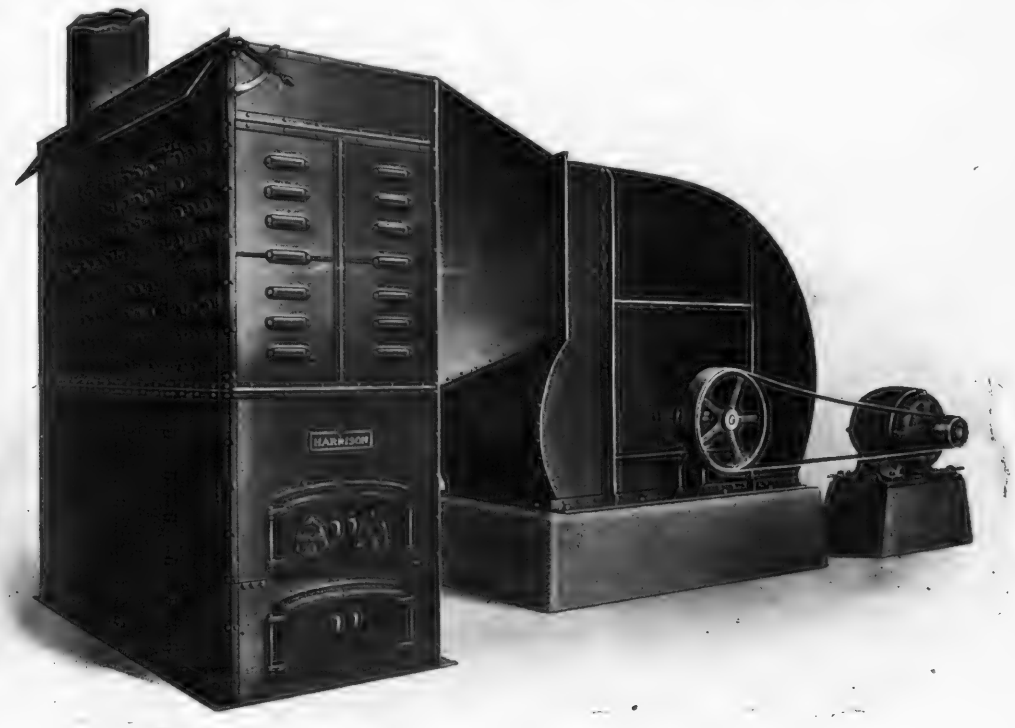
It will be seen that the amount of coal burned was almost exactly proportional to the difference between the inside and outside temperatures; that the internal temperature during the days the building was occupied showed a total variation of only 6°, and in reality it was less than this, as 59° was registered on Friday night after the fires were banked for the holiday Saturday; that the temperature of the building could be kept up during the time it was not occupied to within a very few degrees of the regular temperature with almost 50% less coal consumption, and that the total amount of coal used during this week of severe and variable weather was less than 3,500 lbs., 1 lb. of coal heating slightly more than 72 sq. ft. of radiating surface per hour on an average. This result is directly traceable to the fact that the temperature was held practically uniform at the desired degree of heat, with no wasteful use of steam through overheating.

The New Harrison Aertube Heater

The various savings that would be possible by the use of a direct fuel-to-air heater, thus cutting out the complicated and costly steam installation, has led to the invention of several direct heating systems, some of them fairly efficient. None of them, however, have had heating surfaces fully adapted to the high air velocities involved in the fan system. Their heating area has not been great enough to transmit the large amount of heat required; and not being adapted to sectional installation, these heaters have been of limited individual capacity.

Extreme simplicity and much lower first cost puts the Harrison aertube system, manufactured by the Harrison Engineering Co., New York, in strong contrast with the steam systems. The aertube plant, as previously described in these columns, consists of a furnace under a bank of horizontal tubes through which the air to be heated is driven by a fan, and the distribution ducts. The boiler, feed water heater, pump, traps, coils and return pipes of the steam system are eliminated. This materially reduces its cost and offers small opportunity for repairs, and is one of the principal reasons given for its economy.

Greater efficiency per ton of coal than is obtainable by steam systems, or by other direct heaters, is the second great



HARRISON AERTUBE HEATER WITH BELT-DRIVEN ELECTRIC FAN

source of economy that is claimed for these heaters. The reasons for this are due to the fact that the hot gas from the fire strikes directly on the heating tubes and is distributed among these by baffle plates. The transfer of the heat of the fire to the air passing through the tubes is direct and immediate, commencing as

TUBULAR UNIT OF HARRISON AERTUBE HEATER

soon as the fire is started. An efficiency of 80% or more of the heating power of the fuel is guaranteed in the Harrison heater, and, we understand, has been exceeded in tests.

The air moves through the Harrison heater tubes in a straight line from the fan to the distributing ducts and parallel with the heating surfaces. In addition, the aertube is made on the sectional plan, and so may be adjusted to the heating load in any special case.

While the Harrison system is applicable in any type of building, it is found to be especially satisfactory where the heating system must also provide mechanical ventilation, as in schools, churches, theatres and other buildings of more or less public character. It is particularly adapted to buildings which do not require steam for power purposes, but which have electric power, such as car barns, and also for factories with hydro-electric power. It serves particularly well in garages, where the gathering of explosive vapors must be prevented, and equally well where dust needs to be cleared from the air.

The Harrison aertube heater is made in tubular units or sections of 32 tubes each, the tubes being 4 in. in diameter, 4 ft. long, and supported at the ends in cast-iron tube plates. The patent joint between each tube end and the tube sheet consists of a ring of molded composition packing held in place by a cast-iron expansion ring. It is flexible enough to allow for expansion and contraction, yet absolutely prevents any gas from the furnace getting into the air. The different parts of the casing are jointed on the same plan, the composition packing being held in place by cover plates held by through bolts.

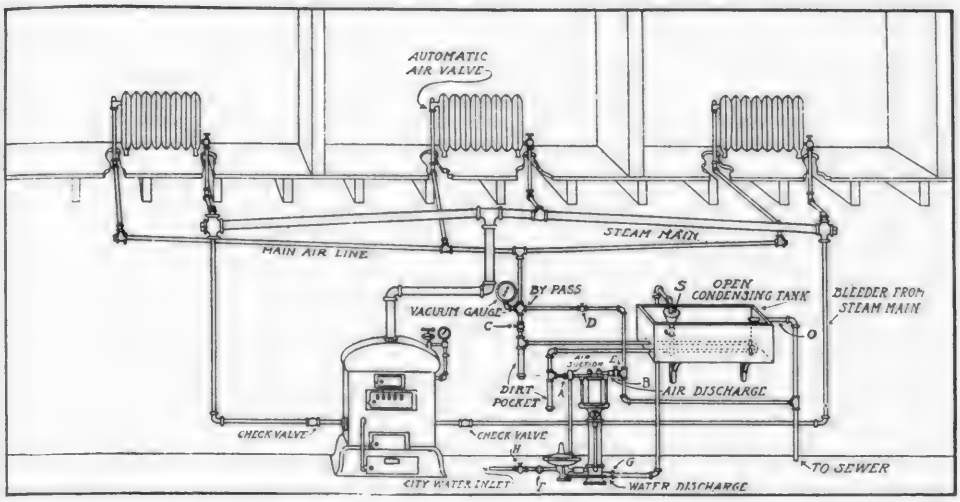
Maintenance cost of the Harrison heater is said to be low, since the parts are all of standard sizes and interchangeable. Consequently the average mechanic can very quickly make the few repairs that may be needed. The aertube heater, it is stated, is the only one of this type on which repairs can be maide while it is in operation.

Fuel adaptability is another interesting feature of the Harrison heater. While coal is the usual fuel, the aertube works remrkably well on the exhaust from gas engines, from forges, ovens and the like, and such waste heat can, if necessary, be used in combination with the burning of fuel on the grate to make up any deficiency. Crude oil gives excellent results. Producer gas is a highly satisfactory fuel when a group of buildings is to be heated, since the gas can be piped from a central producer to aertube heaters in the various buildings. Such an installation avoids the radiation and leakage losses which are a serious drawback in steam heating from a central plant through long pipe lines.

Vacuum Heating Installations with Hydraulic Vacuum Pump

The accompanying illustration shows a typical system of steam heating equipped with the Reliable automatic hydraulic pump, made by the Bishop & Babcock Co., Cleveland O. A separate illustration shows in detail the method of connecting the air and water piping with the pump. This pump is designed to maintain any desired vacuum on the heating system without attention. The automatic cut-off valve which acts as a regulator or governor is adjustable to any desired vacuum from 5 to 25 in., and is claimed to automatically cut out or in on a variation of 1 in. of vacuum. The pump is made in three sizes, which will care for from 1,000 to 20,000 sq. ft. of radiation when the water power available is over 30 lbs. per sq. in. Special pumps are made for large installations when the water power is between 20 and 30 lbs.

In the typical installation shown, an air line is connected to the vacuum pump, this arrangement being possible with either a one or two-pipe system. Before reaching the air cylinder of the pump, the main air line passes through an open condensing tank. The air discharged from the pump passes to the sewer. A by-pass around the pump, for use when the pump is not in operation, permits



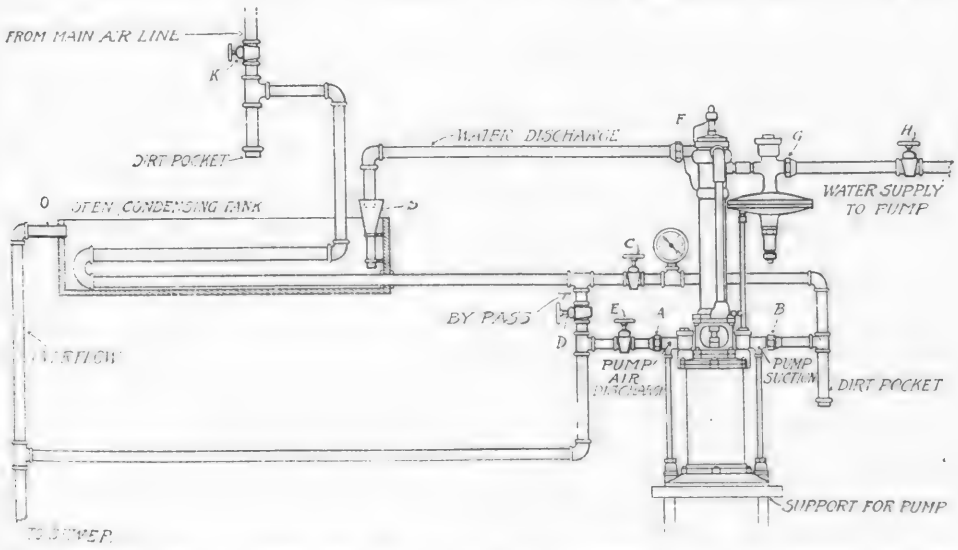
TYPICAL LAYOUT OF STEAM HEATING SYSTEM SHOWING ARRANGEMENT OF AIR LINES FOR USE WITH THE RELIABLE VACUUM PUMP

the air in the air piping to escape in the usual way by steam pressure.

Feed Water Heater With Equipment For Softening the Make-Up Water

Where condensate from a surface condenser or returns from heating or drying systems form a considerable part of the boiler feed supply, it is often necessary to make up the full amount of feed water required by the boiler by adding water which is of a scale-forming or corrosive nature. On account of the disproportionately large cost of putting in a softening system of the usual type for this small amount of water, it is usually fed to the boilers without treatment, with the result that scale is formed in the boilers. While the scale so formed is less than the amount that would be deposited if raw water alone were used for the boiler feed supply, the scale is, on the other hand, apt to be hard and, because of its slow formation, apt to be overlooked, resulting frequently in the unexpected burning of plates and tubes, leakage at seams and tube ends, etc.

This problem has been approached by the Harrison Safety Boiler Works, 3189 No. 17th street, Philadelphia, Pa., who in their recently published Engineering Leaflet No. 7, entitled "Combination Feed Water Heaters and Softening Systems," describe an apparatus designed for plants in which such conditions obtain. This apparatus differs from their



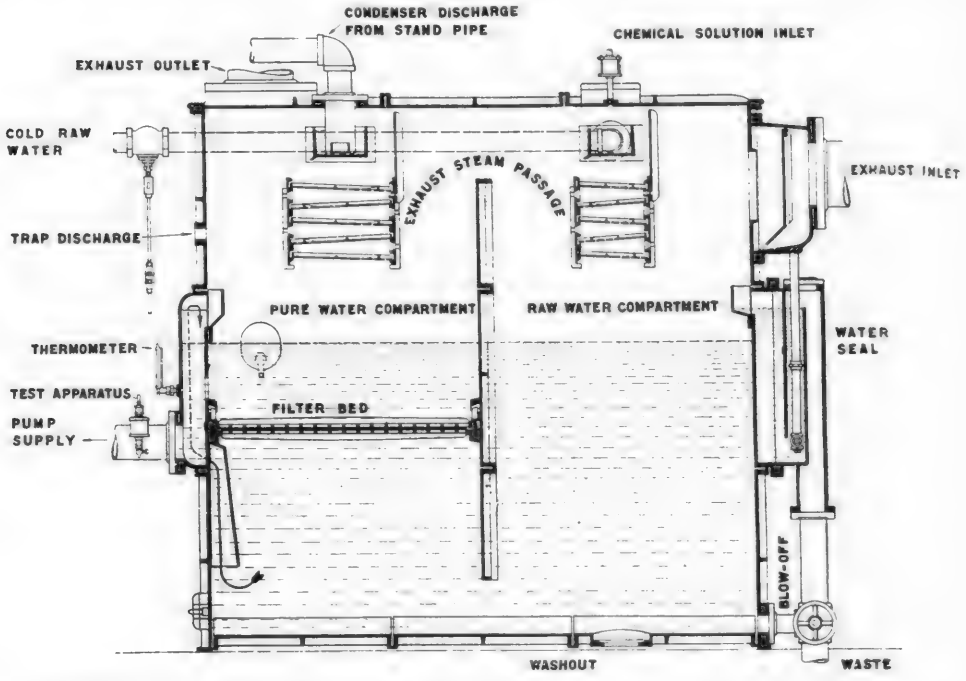
DETAILS OF INSTALLATION OF RELIABLE VACUUM PUMP, AS USED WITH HEATING SYSTEMS

well-known Sorge-Cochrane hot process system in that provision is made for heating the two separate water supplies independently, and for treating only one with a reagent.

The condenser discharge or other returns, after passing over heating trays, pass directly to the pump supply chamber or pure water compartment, whereas the raw water, after heating and mixing with the reagent, falls into a spacious sedimentation chamber and afterwards passes through a filter bed before entering the pure water compartment.

To insure a continuous supply of water to the boilers in case of clogging of the heater which should be installed in any case. For this purpose, it can be adapted to any of the various forms assumed by open feed-water heaters, that is, it can be used as heater and receiver in connection with an exhaust steam-heating system, etc. This pamphlet should prove of interest to all engineers having to do with steam plants where scale-forming water is encountered.

Referring to the illustration, pure water entering the left compartment is heated in falling over the trays and falls at once into the pure water compartment. Raw water entering the right compartment is first mixed with reagent and,



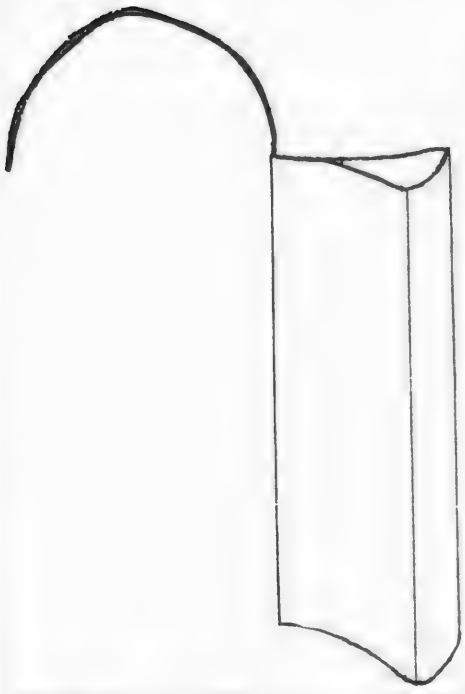
FEED-WATER HEATER WITH EQUIPMENT FOR SOFTENING MAKE-UP WATER

filters, there is an automatic by-pass which, in case the level of the water in the pump supply chamber should fall below a certain level, will supplement with sufficient hot, treated water to supply the pumps.

In a hot process system, the "temporary" hardness, or carbonates, are precipitated by heat, and the only reagent required is that needed for the transformation of "permanent" hardness, such as sulphates, chlorides, nitrates, acids, etc. Due to the use of only one reagent, the management of the apparatus is much simplified, no complicated chemical analyses being required, as where two reagents must be proportioned to the varying requirements of the water. The apparatus has the further advantage over a cold process system in that it performs, in addition, the functions of the feed water after being heated on the trays, falls into a large settling chamber occupying the whole lower part of the apparatus. From this it passes upward through the filter into the pure water compartment. Note self-acting overflow or by-pass at the left from settling chamber to pure water compartment, insuring a supply of hot, softened water to the boilers in case of clogging of the filter.

Hydropan Humidifier

In the course of a lecture on the subject of humidity by Dr. W. W. Brand, health officer of Toledo, delivered before the recent annual convention of the National District Heating Association, (published in THE HEATING AND VENTILATING MAGAZINE for July, 1910), he described a



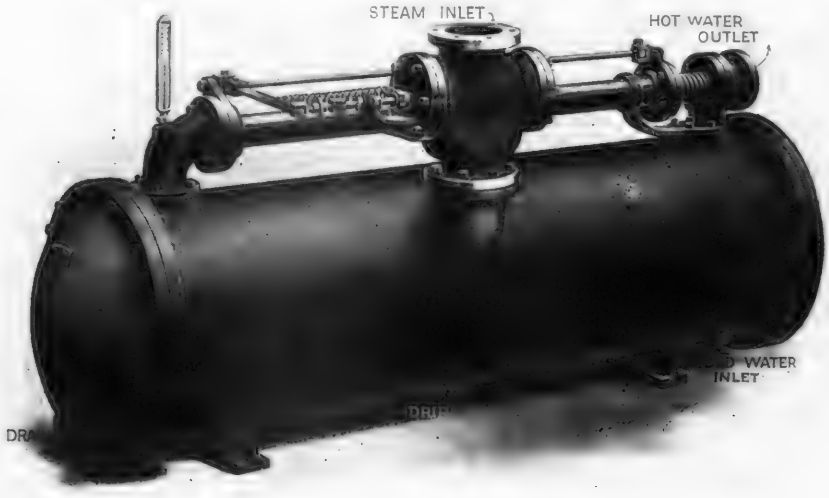
HYDROPAN, DESIGNED BY A. C. ROGERS, FOR SUPPLYING HUMIDITY TO AIR HEATED BY DIRECT RADIATORS

humidifying device which had been designed by Mr. A. C. Rogers, late president of that association. This device, which is known as the Hydropan, is illustrated herewith. It is designed to be hung on the side of a direct radiator and to be kept filled with water. Additional pans may be used to suit the requirements. They fit snugly against the radiator and are made of either galvanized iron or brass. These pans are sold at a nominal price of 25 cents for the galvanized iron and 50 cents for the brass, the latter, on account of its greater transmission qualities, raising the temperature of the water, on the average, about 3° above the other type of pan.

Wainwright Water Heaters for Hot Water Heating

The use of exhaust steam for heating water to be used for warming buildings has led to the development of several devices for this purpose. Hot water is recognized as having certain qualities that commend it for heating purposes, especially as applied to living rooms. However, the difficulty with which it can be handled effectively by natural circulation in greatly exposed parts of buildings and in structures detached from the one in which the source of heat is located, has tended to limit its use. During recent years, however, a forced circulation has been found to effectually overcome these troubles.

The accompanying illustration shows an interesting type of water heater designed to use the exhaust steam from engines, pumps, etc., which can be supplemented, if necessary, by live steam. With this arrangement it is possible to control the temperature in the building at the power plant, in addition to the individual control of the radiators or coils. This is done by changing the temperature of the water, leaving the water heater to suit weather conditions. An additional advantage is the fact that the water mains may be run regardless of grades. The return pipes, for instance, may be run overhead, alongside of the supply mains.



WAINWRIGHT WATER HEATER WITH AUTOMATIC CONTROL

A special use for the heater is suggested in manufacturing establishments where a natural water supply or cooling towers are available for condensing purposes. Here the heater can serve as a surface condenser during the summer and as a water heater in winter.

The circulating pump used with the Wainwright water heater is of the centrifugal type. The water is circulated through the water heater, the flow mains to one or more buildings, the various coils or radiators, and the returns from them are joined into one pipe which connects with the suction of the pump. The only work, therefore, required of the pump is to overcome the friction due to the movement of the water in the system of piping.

The Wainwright automatic control, used with this type of water heater, utilizes in its design the power of expansion and contraction of a metal tube of special composition through which all of the heated water is caused to pass on leaving the heater and before it enters the hot water supply system. This tube is affected by the temperature of the water and regulates the flow at the hot water outlet.

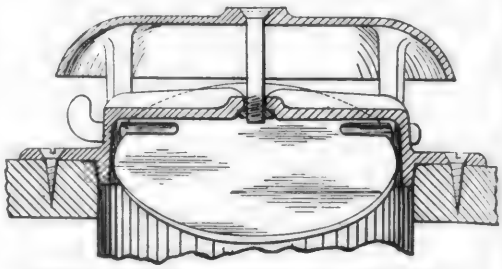
These heaters are made with capacities ranging from 500 to 25,000 gals. per hour. They are manufactured by the Alberger Condenser Co., 95 Liberty street, New York.

The Knowles Mushroom Ventilator

A notable development in the construction of air outlets for use beneath the seats of auditoriums and similar apartments is to be seen in the Knowles Mushroom ventilator, which is designed not only to prevent drafts or other uncomfortable effects of the incoming air, but also to be practically "fool proof."

The present practice in heating and ventilating, and sometimes cooling, a theatre, church or public auditorium by a plenum system below the floor has brought these ventilators into wide use. Being but 6 in. in diameter, they may readily be placed at the fresh air outlet under each chair, the mushroom construction causing the air to be deflected downward and outward in all directions. By setting the valve which controls the opening it has been found to be possible to control the air current to the fraction of a cubic foot per minute. The Knowles Mushroom ventilator is manufactured and sold by George E. Knowles, 69 Beekman street, New York.

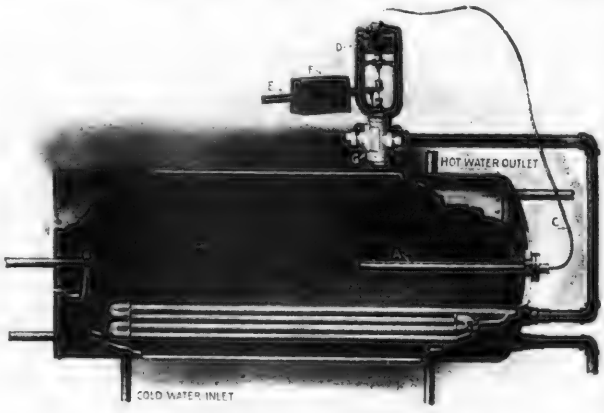
KNOWLES MUSHROOM VENTILATOR



CROSS-SECTION, KNOWLES MUSHROOM VENTILATOR

The Ideal Sylphon Tank Regulator

The accompanying cut shows a new temperature regulator for hot water storage tanks heated by steam. The brass



IDEAL SYLPHON TANK REGULATOR

stem A screws into the storage tank through a 1¼-in. opening B in either the end or the side of the storage tank. A small flexible brass tube C, 3-16 in. outside diameter and 8 ft. long, connects stem A with a metal bellows D, which operates the valve G controlling the flow of steam to the heating coil in the tank. This arrangement permits valve G to be installed at any desired point in the steam line.

Stem A, tube C, and bellows D are hermetically sealed, and confine a liquid which vaporizes at low temperatures. When the water in the tank becomes heated, vapor generated in stem A exerts a sufficient pressure to force some of the liquid through pipe C into bellows D, which expands the latter by overcoming

counterpoise weights F and closes valve G, thereby preventing further admission of steam to the coil in the tank. When the water in the tank cools slightly, some of the vapor in stem A condenses and allows liquid to flow from bellows D, through tube C back into stem A, permitting the bellows to collapse and open valve G. By moving the weight F backward or forward the regulator is adjusted to operate at any desired temperature between 140° and 200° F.

Its use is not confined to storage tanks, but extends to all liquids heated by steam. It has been used on pasteurizing machines, in breweries, sugar refineries, aquariums, sprinkler systems, laundries, etc.

The manufacturers claim extreme sensitiveness of action due to the great power quickly generated by the volatile liquid and to the flexibility of the metal bellows or diaphragm. The outfit is completely self-contained, requiring no auxiliary power and is made entirely of metal. It is sold by the American Radiator Company, 282 Michigan Ave., Chicago, Ill.

Peat as Fuel

Consular Agent John B. Brewer, of Wiesbaden, furnishes the following information concerning the invention of a German engineer which, it is claimed, will make peat "the ideal fuel":

A civil engineer, having his experimental plant in this district, has found and patented a very simple process for extracting, at little expense, all water from peat, of which inexhaustible quantities are found the world over; inexhaustible because of the continuous and steady growth of new peat formations after exploitation of the old.

Knowing that millions of dollars had been spent in the past for the purpose of completely extracting water from peat on a large scale by powerful pressure, as well as by electricity, my attitude toward the new claim was rather skeptical for some time, and therefore I hesitated to report thereon until I had consulted scientists and experts and until the experiments and tests made before me personally had convinced me of the value of the discovery.

The briquettes made from the material so treated furnish a fuel which appears far superior to the best coal, as to caloric power, low price, small specific weight and absence of all smoke and ashes during and after combustion.

The freeing from water is accomplished by the admixture of peat-coke to the peat before pressing in the proportion of 1 to 15. As no extraneous substance is used, there is complete independence from other ingredients. The pressing proper is done by specially constructed and patented machinery of a simple kind. As the three main elements of peat are carbon, hydrogen and oxygen, the process of combustion leaves hardly any ashes, and must seem ideal, since peat contains neither sulphur nor phosphorus nor any other ingredient to which the ordinary smoke nuisance is due.

Heating Apparatus in Argentina

In attendance upon the Argentina Centennial Exposition, and investigating markets for American made goods in South America, Commercial Agent James D. Whelpley writes from Buenos Aires on heating equipments:

Heating apparatus of certain kinds finds ready sale in the Argentine Republic and affords a good field for export from the United States, provided local conditions are understood and national habits are borne in mind. Portable oil stoves offer the best opportunity for trade at present.

In deference to the wishes of the traveling public, most of the newer hotels are supplied with steam heat. The same is true of recent office buildings and of a considerable number of private dwellings of the more expensive sort, but in the latter case the equipment is probably due quite as often to a desire to have all modern conveniences as for comfort's sake.

Still, a rising standard of comfort is discernible all over Argentina, and particularly in its metropolis and capital, Buenos Aires. The vast agricultural riches of the country which lie beyond it have made this city rich beyond the knowledge of the average European or North American, and there is a large class able to pay for whatever it wants or considers up to date in its homes. National customs are founded largely on economic conditions, and the sparing use made of heat in Southern Europe has come about mainly, no doubt, on account of the high price of fuel. In Argentina fuel is equally or more expensive, but there is a far larger proportion of the population able and willing to pay for it. Hence, the heating of houses by some method is growing greatly, and offers commercial opportunities for the future which should not be overlooked.

Steam heat, as already suggested, is used only in exceptional instances, and it is doubtful if there is any field for United States firms in that direction at this time. Such means of heating is now supplied by European companies, which not only sell the equipment, but also install it. Builders naturally want to include the latter service in the contract, and no firm unprepared to do so would stand much chance of business. Furnace heating is more infrequent than steam plants in Argentina, and affords equally scanty opportunity for trade.

New Book on Exhaust Steam Heating

In our last issue we referred to a notable book, comprising, as its sub-title indicates, an exhaust steam heating encyclopedia, recently published by the Harrison Safety Boiler Works, 3189 North 17th street, Philadelphia, Pa. This book is so unusual as to be worthy of further description. In connection with the various exhaust steam heating systems which it describes, as well as the ordinary gravity return and back pressure systems, the diagrams illustrating these systems are printed in three colors, making possible a most interesting comparison of the ideas of the several inventors and manufacturers. A point clearly brought out is the adaptability of the new Cochrane steam-stack and cut-out valve heater and receiver wherever exhaust steam is to be used for heating or drying purposes.

One of the chapters is devoted to a discussion of the exhaust steam heating problem in connection with condensing plants and low pressure turbines, while over thirty pages are occupied by tables and engineering data, which should prove of value to all who design, install or operate exhaust steam heating systems. The book, which is handsomely printed and bound, will be supplied to anyone interested in these matters. Size 6x9 in. (standard). Pp. 120.

Heat Economy in Paper Mills is the title of a pamphlet just issued by the Green Fuel Economizer Co. This pamphlet gives an interesting discussion as to the most economical methods of utilizing heat in paper mills, and points out that contrary to the usual custom of using high pressure engines in order to have exhaust steam available, it is possible to obtain better plant economy by using high efficiency condensing engines or turbines and heating the water necessary in the mill by means of a fuel economizer.

A number of tests in paper mills are given, in which it is shown that an economizer can be used either solely for heating boiler feed water or for heating the other water necessary about the plant, a substantial fuel economy resulting in either case.

In one test quoted, the conditions are rather unusual. The economizer raising the temperature of the water only 20°, but due to the enormous volume passed through it, this comparatively slight rise in temperature is equivalent to a saving of $2,743 per year in the fuel bill.

Photographs of a number of recent installations are shown, as well as a number of typical layouts of economizers in the paper mills.

Copies of this publication can be had free of charge by writing to the Green Fuel Economizer Co., Matteawan, N. Y.

Carb-Ox Specialties, comprising an interesting line of portable gas analysis instruments and allied specialties, are illustrated and described in a catalogue published by the Carb-Ox Co., Rogers Park, Chicago, Ill. Among apparatus shown are the Hays gas analysis instrument for CO_2, O and CO, both with and without Pipette attachment, the Hays gas sampling apparatus, for use in connection with the other instruments where great acuracy in gas sampling is desired; also Hays automatic CO_2 recorder, CO_2 indicator, draft recorder, draft indicator, low efficiency alarm and recorder, all combined in one apparatus. Additional devices shown in the catalogue are an automatic gas calorimeter and the Hays automatic damper regulator, while still other products of the company include differential draft gauges, oil testing apparatus and recording thermometers. Size 3¾x 8½ in. Pp. 16.

Foundry Heating Systems is the title of a pamphlet recently published by The Green Fuel Economizer Co., Matteawan, N. Y., containing detailed descriptions of two novel installations recently put in by this company. In one of these installations a foundry of 515,000 cu. ft. capacity and having walls made up entirely of glass was successfully heated by a small four-section Positivflo heater. The pamphlet also describes a novel arrangement of ducts whereby the heat is supplied just where needed by the workmen, at the same time furnishing them with fresh air, and forcing the smoke and gases out of the building through the skylight. By using the right number of heater sections, and regulating the volume of air delivered, it is also possible to maintain the foundry at such a temperature that cores and moulds will be prevented from freezing, no matter how severe the weather conditions.

Current Heating and Ventilating Literature

Under this heading is published each month an index of the important articles on the subject of heating and ventilation that have appeared in the columns of our contemporaries. Copies of any of the journals containing the articles mentioned may be obtained from THE HEATING AND VENTILATING MAGAZINE *on receipt of the stated price.*

Mechanical Plant of the Provident Bank Building, Cincinnati. Walter C. Franz. Plans and description of a plant for a 10-story building. 1,600 w. Eng Rec—May 28, 1910. 20c.

A Palatial Steam Power Plant. A. R. Maujer. Illustrated description of the mechanical plant for furnishing heat, light, elevator service, etc., in Charles Schwabs's New York residence. 1,500 w. Power—June 28, 1910. 20c.

TRADE AND MISCELLANEOUS NOTES

Miscellaneous Notes

June Building Operations in 45 cities show a very slight decrease from those of the corresponding period a year ago. The Eastern cities report a decrease of 13%; Middle West, a decrease of 1.6%; Pacific Coast cities, an increase of 5%; and the Southern cities, an increase of 32%. The total building operations for the month amount to $54,309,669, as against $56,927,491 for June, 1909.

Thomas Morrin, San Francisco, Cal., sailed July 16 for England to attend the joint meeting of the American and British societies of mechanical engineers.

Interstate Light & Power Co., Platteville, Wis., announces that it will discontinue its service of steam heat. The plant supplies 25 buildings which will be forced to make other arrangements for securing heat for warming purposes.

San Francisco, Cal.—A conference was arranged recently by the local Board of Education to discuss the relative merits of steam heating and hot air heating for school buildings. The conference was the result of the stand taken by the superintendent of public schools of San Francisco against the use of cast-iron sectional steam boilers for schools. Among the heating and ventilating engineers who attended the conference were T. B. Hunter, R. A. Hudson, Thomas Morrin and W. E. Leland. Comparative tests of the two systems were recommended, although no definite action was taken.

Central Heating Co., Detroit, Mich., is building an $18,000 addition to its coal storage plant on Holden avenue.

Waukesha Gas & Electric Co., Waukesha, Wis., has completed its new electric station and central heating plant.

Anderson, Ind.—The city council has granted a franchise to the Comfort Heating Co., of Frankfort, to lay a line of

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steam piping from the plant of the Indiana Dairy Co. to the city school buildings at Lincoln and Fourteenth streets, to heat the school buildings.

Carroll, Ia.—The city council has passed an ordinance amending the franchise of the local heat and power company, increasing the maximum rate for heat from 20 to 25 cents per square foot of radiation. The company supplies 85,000 sq. ft. of radiation and the increased rate was concurred in by consumers on the basis of improved service on the part of the company.

New Ulm, Minn.—A central heating plant is proposed for New Ulm, utilizing the exhaust steam from the city's water and electric light plant. In addition to supplying the business section of the city, it is proposed to supply heat to the public schools, court house and jail and to Turner Hall.

Builders' and Manufacturers' Exchange of the District of Columbia has been chartered to advance the commercial interests of Washington, D. C., with special reference to its building development. Among the directors is Thomas Eagan, a well-known master steamfitter of Washington.

New York—Architects Cady & Gregory have filed plans for building a new chimney and low pressure heating plant in the Brick Presbyterian Church at Fifth avenue and 37th street, New York, the work to cost $4,000.

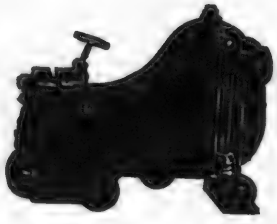
Master Steam and Hot Water Fitters of California have formed an organization with the following members: M. Levy Plumbing & Heating Co., the R. Dalziel, Jr., Co., Mangum & Otter, H. W. Moffat, Lennig-Rapple Co., John G. Sutton Co., Turner Bros. Co., Wittman-Lyman Co., Pacific Fire Extinguisher Co., Royal Heating Co., Timothy Collins, Gilley-Schmidt Co. and J. E. O'Mara. The following officers have been elected: President, F. W. Howard; vice-president, E. B. Lennig; secretary and treasurer, R. P. Lindsay.

Manufacturers of enameled plumbing goods, including a number of boiler and radiator manufacturers, are defendants in a suit brought by Attorney-General Wickersham to dissolve the so-called "bathtub trust." Among the heating concerns affected is the McCrum-Howell Co., New York; also Lloyd G. McCrum and Howard T. Gates, of the McCrum-Howell Co.

International Municipal Congress and Exposition, heralded as the world's greatest exploitation of municipal progress and perfection, will be held in Chicago, Ill., September 18-30, 1911, a little over a year hence. The exposition will

McDaniel Improved Steam Trap

WILL DO THE WORK



When you need a Steam Trap buy one you know will work. With a McDANIEL we take all the chances. Don't pay until you are satisfied. We have been 25 years manufacturing Steam Traps and know there is no better trap made. May we send you one for trial?

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ASK FOR BULLETIN 101

AMERICAN DISTRICT STEAM COMPANY

LOCKPORT, N Y. CHICAGO, ILL.

be held in the Coliseum, Armory and Exposition Grounds.

Manufacturers' Notes

Griscom-Spencer Co., 90 West street, New York, has purchased the patents and good-will of the Goubert Mfg. Co., Bergen Point, N. J., and will manufacture and sell hereafter the steam separators and feed water heaters formerly made by the Goubert Mfg. Co., in addition to its own line of Reilly multi-coil feed water heaters, Bell humidifiers and other specialties.

Selzer Heating Co., Akron, O., announces the election of J. A. Swinehart as its president and C. W. Clever, secretary. The company, which has recently increased its capital stock from $20,000 to $50,000, has moved into new quarters at 42 North Howard street, where additional facilities will be provided for the manufacture of its line of Selzer water heaters.

Moore Heating & Mfg. Co., Akron, O., has taken quarters in the Power Block in Canton, O., in quarters formerly occupied by the Hedgeland Mfg. Co., where it will manufacture its line of heating supplies. The company's new home contains 30,000 sq. ft. of floor space.

Crane Co., Chicago, announces the appointment as manager of its branch at Vancouver, B. C., of J. B. McElwaine, formerly of the Indiana Supply Co. Work will soon begin on Crane Company's new building at Tacoma, Wash., which is to cost $50,000.

American Foundry & Construction Co., Pittsburg, Pa., will supply Crescent expansion joints, anchors and traps for the new 20-in. underground steam main of the Merchants' Heat & Light Co., of Indianapolis, Ind.

Alberger Condenser Co. and Alberger Pump Co. have moved into new quarters in the West Street Building, 140 Cedar street.

Isaac A. Sheppard & Co., Philadelphia, Pa., celebrated the fiftieth anniversary of its organization June 21-23 at Philadelphia and Baltimore, respectively. The company was organized May 16, 1860, to deal in stoves and ranges. Its line of steam and hot water boilers and other apparatus was added in 1890.

Berlin Construction Co. has received the contract for rebuilding the fan shop of the Green Fuel Economizer Co., at Matteawan, N. Y., which was almost totally destroyed by fire some weeks ago. It is expected to have the new building erected and complete, ready for occupancy, about the middle of August. The new shop will have about 25% more floor space than the old shop, including a test room fully equipped with chambers,

The Heating and Ventilating System Does Not Operate Properly

How often is this comment heard? Why, then, install an expensive heating and ventilating system if it is not to be kept up to its initial standard of efficiency?

What a Burglar Alarm is to a House the Standard Recording Thermometer is to a Heating System.

Standard Recording Thermometers will tell exactly if the system is producing results. Every degree of temperature during every hour of every day of every week is accurately recorded and comparisons can be made so as to enable an even temperature to be maintained.

Standard Recording Thermometers are necessary adjuncts to the successful operation of every heating and ventilating installation.

Our Catalogue H contains full information regarding sizes, styles and prices.
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Standard Thermometer Co., Clinton and Shirley Sts., Boston, Mass.

gauges, etc., suitable for making exhaustive tests on the capacity, pressure and efficiency of the improved fans built by this concern for heating and ventilating, mechanical draft and other services. The new building will be of steel construction throughout and will be heated by the hot blast system, with frequent outlets near the floor to secure uniform distribution of the heat. This system has been applied by the Green Fuel Economizer Co. with great success in several buildings that were peculiarly difficult to heat, such, for instance, as the new foundry of the Waterbury Castings Co., where the wall surface is almost entirely of glass.

Business Troubles

Pullman Automatic Ventilator Co., New York, through its receiver, William Birnstock, has filed an inventory showing the company's liabilities to be $571,537.45 (including $500,000 capital stock) and assets of $89,999.63 tangible, and $295,000, assets and good-will.

Smokeless Heat & Power Co., Cleveland, O., has had a bankruptcy petition filed against it in the United States District Court by the Gas Power Producing Co., of Lima; G. L. Pike, of Canton; and Peter J. Sult, of Marietta. The claims of the petitioning creditors amount to about $3,000, and the petition claims that the company is in debt to the extent of $6,000.

New Firms and Business Changes

Selzer Heating Co., Akron, O., has increased its capital stock from $20,000 to $50,000.

Strand Heater Co., Cleveland, O., has increased its capital stock from $10,000 to $25,000.

Snyder Heating Co., Rockford, Ill., has sold its business to the Peck-Williamson Heating & Ventilating Co., of Cincinnati.

New Corporations

Automatic Sprinkler Co. of America, Croton, N. Y.

Independent Plumbing & Heating Co., Seattle, Wash. Capital, $1,000.

Wechtel Plumbing Co., Toledo, O., capital $50,000, to conduct a heating, plumbing and gas fitting business. Incorporators: H. J. Chittenden, R. M. Marks, Robert Newbegin, M. A. Matthews and G. Andrews.

J. Sheehan Plumbing Co., St. Louis, Mo., capital $3,000, to conduct a heating and plumbing business.

Richter Co., Cincinnati, O., capital $80,000, to conduct a heating and plumbing business. Incorporators: Edward B. Richter, Louis A. Richter and Amelia J. H. Richter.

Elgin Damper & Heat Regulator Co., Elgin, Ill., capital $25,000, to manufacture heating specialties. Incorporators: F. C. Guptill, M. J. O'Neill and E. L. Ryan.

McKuster Co., Portland, Ore., capital $20,000, to conduct a heating and plumbing business. Incorporators: Joseph McKuster, R. W. Wilbur and S. C. Spencer.

Haskins Boiler Co., New York, has opened offices at 31 East 21st street, in quarters formerly occupied by the J. H. McLain Co. The new company will handle the McLain boilers, besides conducting a jobbing business in heating specialties. President, E. O. Haskins.

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ASBESTOS AND MAGNESIA COVERINGS, ROOFINGS, PACKINGS, FIRE-PROOF AND COLD STORAGE INSTALLATION, ELECTRICAL AND PLUMBERS' SUPPLIES, ETC.
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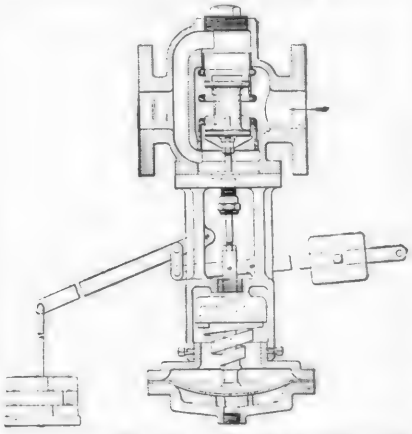
formerly with Abendroth Bros., Portchester, N. Y.; secretary, C. E. Witherspoon, also formerly with Abendroth Bros.

Jolly, Wieland & Richardson Co., Olney, Ill., capital $20,000, to conduct a general heating and plumbing business. Incorporators: T. M. Richardson and C. F. Wieland.

Howell-Melville Co., Philadelphia, Pa., incorporated to manufacture and deal in heating and plumbing supplies. Incorporators: George B. Howell, James N. Melville, Will B. Hadley, E. W. Howell and William F. Bernstein.

Dawson Gas Generator Co., McKeesport, Pa., capital $150,000, to manufacture and deal in devices and patents for generating gas for heating, lighting and power purposes.

WATERS
Reducing Valves
for steam heating purposes a specialty.
Also valves for vacuum heating systems.



Manufactured by
Waters Governor Co.
34 Oliver St., Boston, Mass.

Contracts Awarded

Lewis & Kitchen, Chicago, heating and ventilating Union School building at Lyons, N. Y., for $9,850.

F. D. McQuealey Co., Hastings, Neb., heating and plumbing St. John's Hotel at Hastings for $2,250.

Moline Heating & Construction Co., Moline, Ill., heating and ventilating Irving School at Moline for $9,674.72.

American District Steam Co., Lockport, N. Y., construction of steam heating system at Streator, Ill., for D. Heenan. The plant will cost $20,000.

West End Heating & Engineering Co., Philadelphia, central heating plant at Mont Alto Sanatorium. The work will cost $77,523.

G. A. Kees Domestic Engineering Co., St. Paul, Minn., heating and plumbing U. S. court house and post office at Keokuk for $6,987.

Noble Plumbing & Heating Co., Princeton, Ind., heating and ventilating the Lowell school building at Princeton for $2,675.

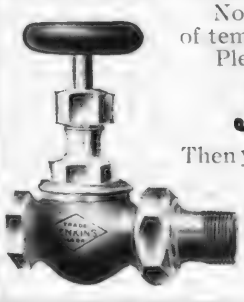
Miller & Co., Hoopeston, Ill., heating and ventilating new high school building at that place.

Hess, Rau & Co., Sioux Falls, S. D., heating and ventilating high school building for $6,500.

Jennison Plumbing Co., Fitchburg, Mass., heating and ventilating Goodrich Street School in Fitchburg for $6,200.

M. C. Vandiver Co., Atlanta, Ga., was the lowest bidder for the heating and ventilation installations in nine public school buildings in Atlanta, including the State Street, Bell, Inman Park, Formwalt, Gray, Fraser, Boulevard, Calhoun and Girls' High School. The company's bid for all nine schools was $26,800. Among the other bids received were the following: Moncrief Furnace Co., Atlanta, $40,485.25; Lewis & Kitchen, Chi-

PERFECT SERVICE DEPENDS UPON THE VALVE



No matter how fine the system, a leaking valve makes regulation of temperature impossible.
Please your clients by specifying the **genuine**

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Then you are assured of receiving valves which are thoroughly reliable, absolutely guaranteed, and ultimately the most economical.
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cago, $37,567; Barbour Plumbing Co., Birmingham, $34,072.54; Peck-Hammond Co., Cincinnati, $36,363; Stapel Heating & Ventilating Co., Atlanta, $39,490.

Ahern-McCoy Co., Fond du Lac, Wis., heating and ventilating new high school building at Fond du Lac for $11,483. The plumbing contract went to David Ahern & Son Co. at $3,084.

C. H. Norton, Marinette, Wis., heating and ventilating and plumbing school building at Marinette for $3,337, for the heating and ventilating; and $1,315, for the plumbing and vacuum cleaning apparatus.

Atlas Heating & Ventilating Co., San Francisco, Ca., heating and ventilating Franklin Grammar School on Eighth street, San Francisco, for $9,630. The plumbing contract went to William S. Snook & Son at $3,336.

Hoffman & Meuser, San Francisco, Cal., heating and ventilating bank for San Francisco Savings Bank for $11,000.

Bell & Wilson, Eugene, Ore., installing central plant for the Eugene Heating & Power Co. at Eugene.

Salina Plumbing Co., Salina, Kan., central heating plant for the State Normal School at Hayes for $30,000.

Symmes-Powers Co., Sioux Falls, Ia., steam heating central school building at that place for $6,500.

McCreery Air Washer

MADE IN

GALVANIZED IRON AND COPPER

ALSO MADE IN

RE-INFORCED CONCRETE

which is *practically indestructible* as it cannot *rust* or *corrode*. The entire inside surface of the spray chamber is water-proofed and given a sanitary finish. All the advantages of our cleaning surfaces are retained.

If you need a complete small ventilating and air purifying plant which will fit in restricted space and will cost little to operate, buy one of our *Self-Contained Equipments*.

Descriptive circulars, giving dimensions, mailed on request

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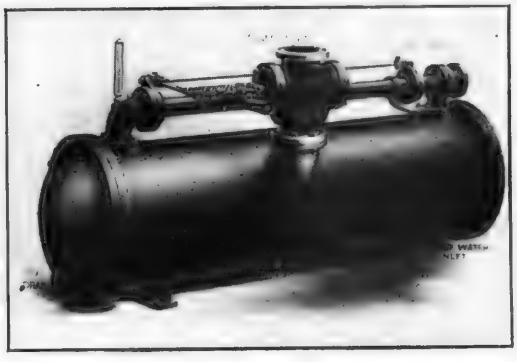
An UNLIMITED Supply of Hot Water at Any Desired Temperature Assured



Cast Iron and Pure Copper only Used in its Construction

We refer you to those who have been convinced that these are the most phenomenal heaters on the market. A well-known consulting engineer says: "We are surprised at the efficiency of your apparatus as the writer did not think a heater occupying so little space would be capable of doing the duty."

ALBERGER CONDENSER COMPANY

140 Cedar St., New York City

PITTSBURGH **CHICAGO** **ST. LOUIS**

Downey & Kruse Co., Milwaukee, Wis., heating and ventilating new $60,000 city hall building at Kenosha, Wis., for $4,173.

O. S. Kendall & Son, Worcester, Mass., heating and ventilating Woodland Street school at Worcester for $3,146.

Robbinis & Gamwell, Pittsfield, Mass., steam heating American House at Pittsfield.

John O'Brien Boiler Co., St. Louis, Mo., heating State Hospital No. 1 at Fulton, Mo., for $26,150.

Harrison Engineering Co., New York, heating $275,000 residence of Capt. J. R. DeLamar at Glen Cove, L. I. The Harrison aertube heating system will be used.

F. W. Zemier Co., Boston, setting up and piping boiler for the Lowell school building, Boston, for $3,000.

Abel P. Randall, Westerly, R. I., steam heating Elm Street School building at that place.

Business Chances

Washington, D. C.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, for the following-named work:

Until August 18, 1910, for the construction complete, including plumbing, gas piping, heating apparatus and electric conduits and wiring, of the U. S. Post Office at Pontiac, Mich.

Until August 22, 1910, for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, of the U. S. Post Office at Carbondale, Pa.

Until August 26, 1910, for the installation of a steam heating and ventilating apparatus, etc., for the U. S. Post Office building at St. Louis, Mo.

Position Wanted, by technical graduate in electrical engineering, with a heating and ventilating concern where energy and ability will be recognized. Has been connected with the trade for several years. Willing to work up. Address Electrical, care of HEATING AND VENTILATING MAGAZINE.

Position Wanted, by heating and ventilating engineer, technical graduate, eight years' practical experience in heating and ventilating public buildings, school houses and factories. The fan system a specialty. Address S, care of HEATING AND VENTILATING MAGAZINE.

Position Wanted, as estimator for heating and ventilating work, or as superintendent of heating installations. Ten years' experience in all branches of heating and ventilating designing, including the hot blast, vacuum, etc. Address X, care of HEATING AND VENTILATING MAGAZINE.

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Comprising all the statutes now in force in this country regulating the ventilation of school and other public buildings

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Trade Literature

A Few Points on Steam Traps in General and the Strong Trap in Particular is the title of an interesting circular published by the Strong, Carlisle & Hammond Co., Cleveland, O., calling attention to details of construction of the Strong steam trap. This trap is made with capacities ranging from 1,300 to 40,000 sq. ft. of radiation. The action of the trap is intermittent and operates by means of an open bucket. The valve is not opened until sufficient condensation is collected in the trap to cause the bucket to sink. When this takes place, the valve is thrown wide open, which permits the difference in pressure between that carried in the line and the atmosphere to be brought to bear upon the condensation that may be lying in the line.

This action affects the water that is lying in the sags and pockets and draws to the trap the drops of condensation formed on the inside of the pipe line, which cuts down the radiation. In addition to this advantage, the trap is so made as to be easy to inspect and has but two wearing parts, the valve and seat. These may be inspected without removing the trap from the line or disconnecting it.

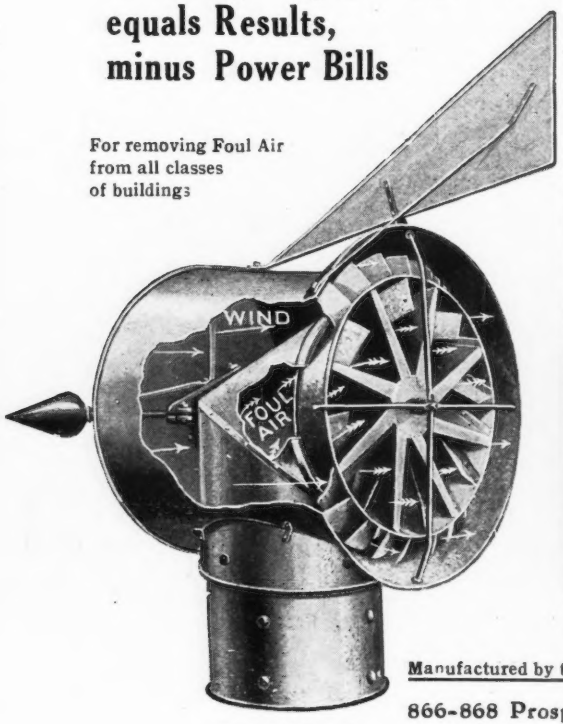
Nonpareil Corkboard Insulation, made by the Armstrong Cork Co., Pittsburg, Pa., designed especially for refrigerating purposes, is described at length in a handsomely printed book, containing some 73 illustrations, many of them photographic reproductions, showing the construction of this insulation, together with views of typical installations. The general subject of insulation is thoroughly covered, and a number of tables and charts are presented showing results of tests of Nonpareil corkboard under a variety of conditions. The book is bound in cloth and should be an interesting addition to the libraries of those interested in refrigeration. Size 6x9¼ in. Pp. 118.

J-M Packing Expert for July, 1910, published by the H. W. Johns-Manville Co., New York, contains, among other things, an interesting article descriptive of the J-M metallic packing (Bullock patent), a new mechanical packing the company has recently placed on the market. The packing is self-lubricating, being so constructed that small reservoirs are formed in the various rings that retain lubricating oil, thus assuring constant and thorough lubrication. Although of segmental construction, when assembled on a rod it takes the form of a solid ring, and the manufacturers state that it is impossible for one segment to turn up on edge and score the rod.

Vulcan Round Steam Boilers and Hot Water Heaters is one of the newest pub-

"Bi-Cal-ky"—plus—The Wind equals Results, minus Power Bills

For removing Foul Air from all classes of buildings



Patents Pending

Above test made with a 15-mile wind velocity

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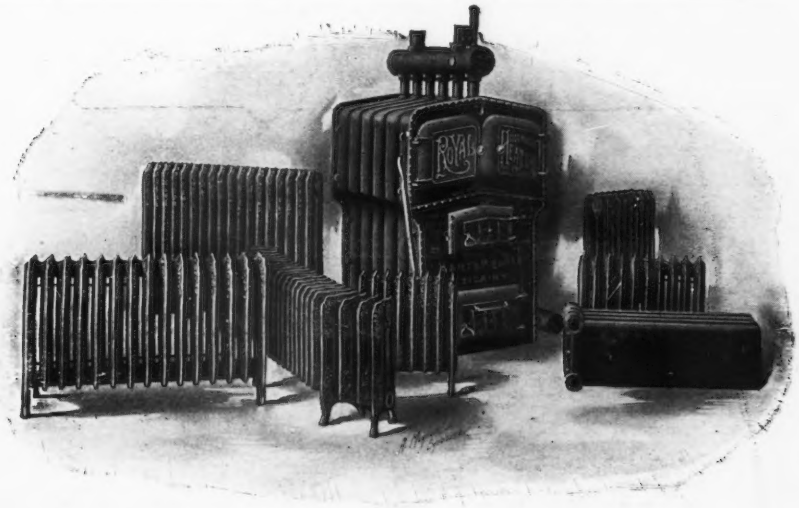
lications of the Williamsport Radiator Co., Williamsport, Pa., giving price lists adopted May 1, 1910, for this type of heater. The Vulcan steam boilers are made with grates ranging from 15 to 36 in. in diameter and with capacities of from 200 to 1,800 sq. ft. of direct radiation. The hot water heaters have grates from 15 to 36 in. in diameter and corresponding capacities of from 325 to 2,900 sq. ft. of direct radiation.

Craig Sectional Boilers for Steam or Water and Koran Radiators are presented in a new price list published by the makers, the Williamsport Radiator Co., Williamsport, Pa. The boilers include 36-in., 24-in., 18-in. and 15-in. steam and water boilers, with various depths of grate for each size. Accompanying the price lists are photographic sectional views showing details of construction and course of flue gases. Koran radiators are given in various heights from 20 to 45 in. for two and three-column types. The catalogue also includes a number of specialties for use in heating systems, with price lists, etc.

Graphite for July, 1910, published by the Joseph Dixon Crucible Co., Jersey City, N. J., contains descriptive matter on the effective service of Dixon's paint on gas holders, water towers and on the Buffalo River bridge, which was painted with Dixon's silica-graphite paint in 1902, and is reported to be good for another like period of service.

Table of Capacities of "A B C" Heater Sections in terms of square feet of actual heating surface is presented in a new bulletin (No. 273) published by the American Blower Co., Detroit, Mich. The manufacturers state that the table gives a bona fide actual rating upon which engineers can absolutely rely. The further statement is made that the table is now published for the first time outside of the manufacturers' private data books. The "A B C" heater is what is popularly known as a sectional base heater, each section consisting of a cast-iron base, with four rows of holes tapped into the top. In these holes are screwed 1-in. steam pipe. The upper ends of each alternate row are joined together by elbows with short horizontal nipples between. A special feature of the construction of the base of this heater is its division into two compartments by a partition running the whole length from end to end, preventing communication between the two compartments except through the vertical heating pipes. The bulletin includes photographic views of some of the many possible combinations of "A B C" heaters with fans. Size 7x9 in. Pp. 20, the table of capacities being of double page size.



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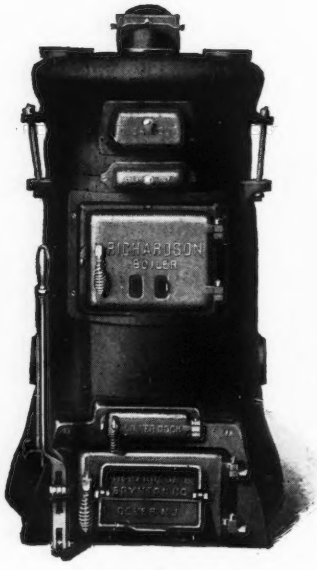
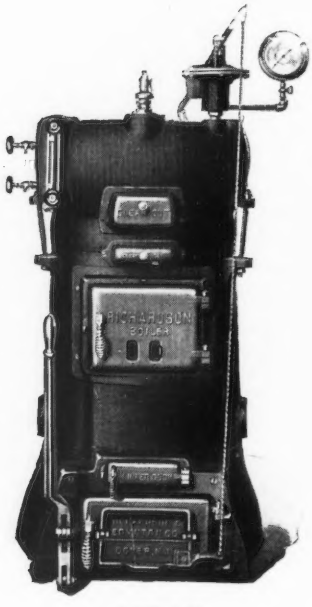


HOT WATER



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